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Color Atlas of Ultrasound Anatomy

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Preface

Ultrasound scanning yields a series of sectional images. The basis for interpreting the examination is the individual sectional image. At first sight, it is easy to be confused by the variable appearance of an ultrasound scan of the same region in different patients. This has numerous causes, including differences in density, body fat, age-related differences, overlying gas, and artifacts. In most cases the apparent discrepancies are not based on true anatomical differences. When a systematic scanning routine is closely followed, series of sectional images can be obtained in every patient with remarkable consistency. Even if the images themselves vary, the anatomical relationships that are demonstrated remain constant.

While some excellent atlases have been published on computed tomography and magnetic resonance imaging, it is curious that no one (to the author's knowledge) has taken the trouble to create a similar atlas of sectional anatomy for abdominal ultrasound. The present atlas attempts to fill this gap. In particular, the author hopes to provide the beginner with a comprehensive guide to the initially confusing world of sonographic anatomy.

Many have helped in the creation of this book. I wish to thank Dr. Hartwig Schöndube and Dr. Matthias Geist, who gave me some scans. I also thank Mrs. Stephanie Gay and Mr. Bert Sender of Bremen for their superb rendering of the illustrations. I am also grateful to the staff at Thieme Medical Publishers for enabling me to make this book a reality, with special thanks to Dr. Antje Schönpflug, Mrs. Marion Holzer, and, of course, Dr. Markus Becker.

Braunschweig, Spring 2004 Berthold Block

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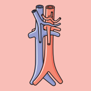
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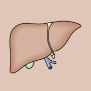
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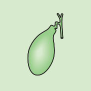
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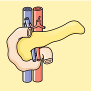
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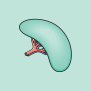
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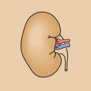
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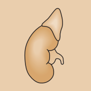
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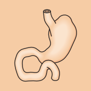
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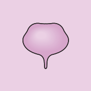
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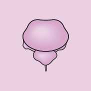
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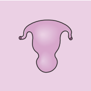
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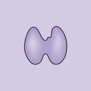
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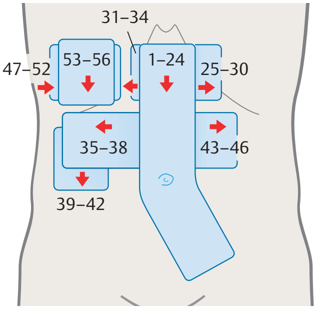
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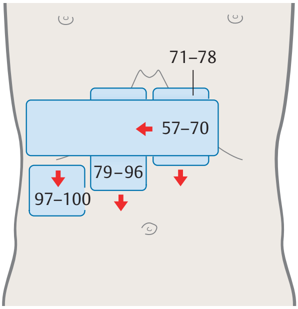
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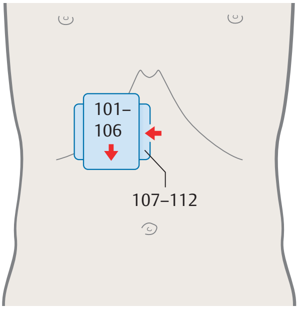
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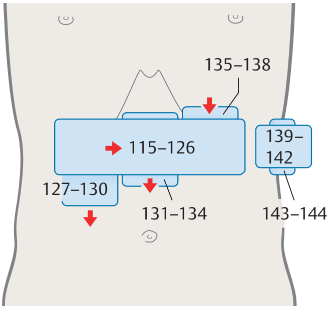
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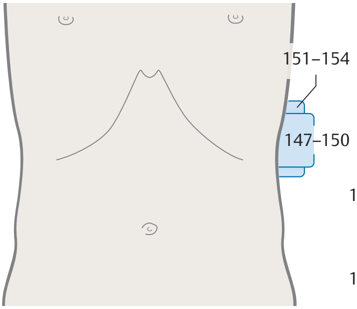
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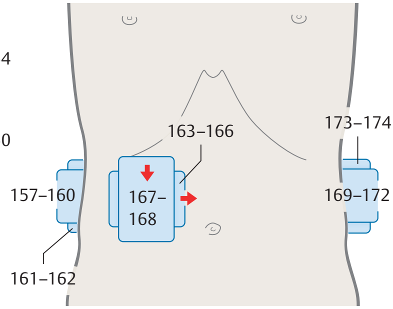
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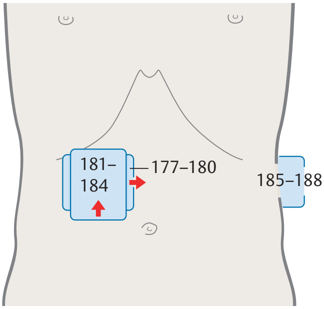
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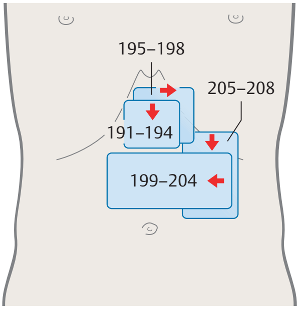
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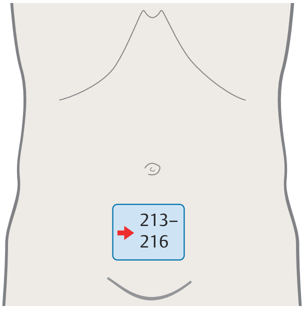

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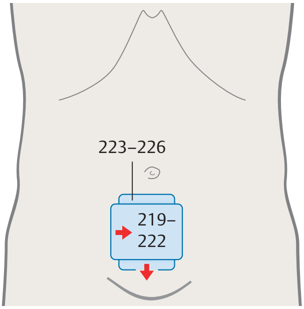
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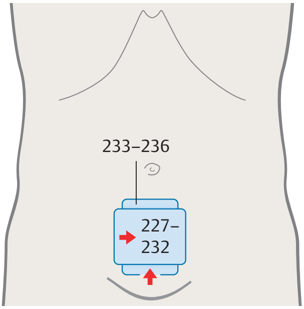
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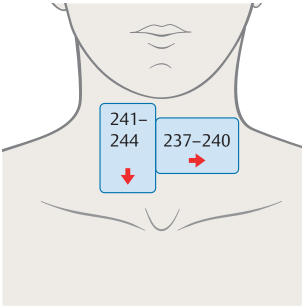
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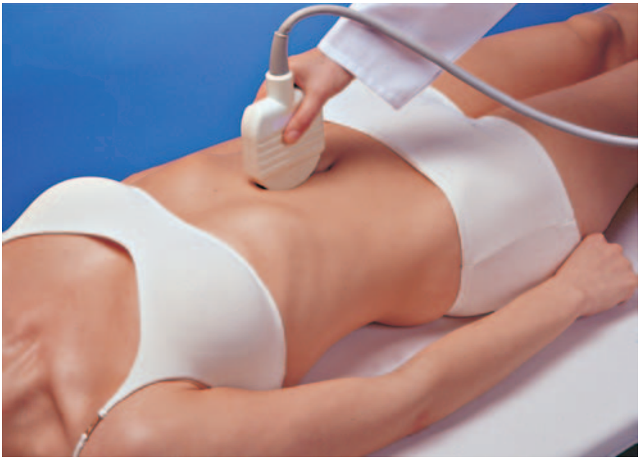

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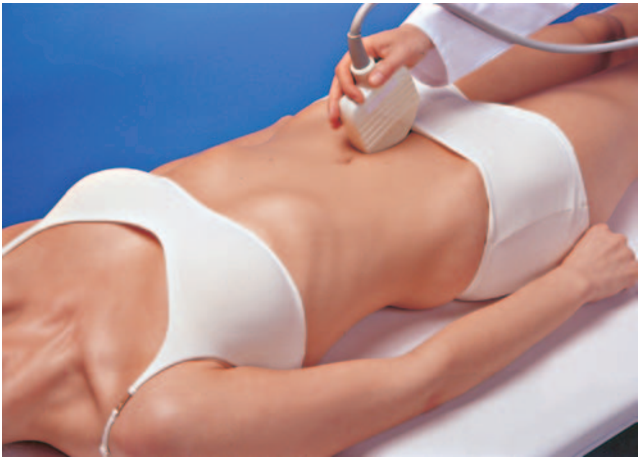

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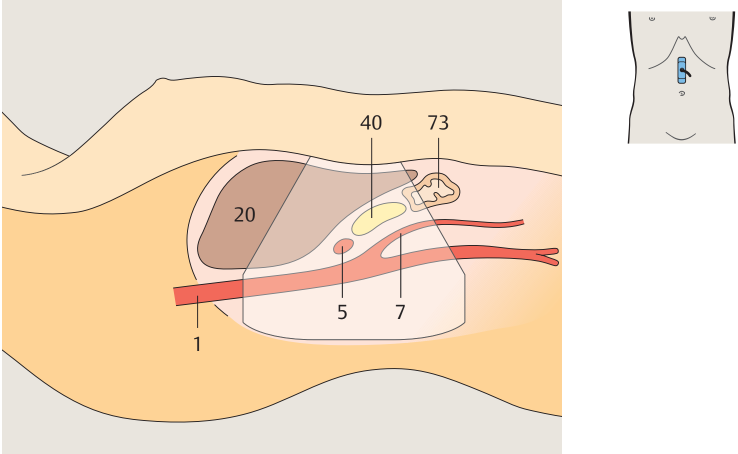
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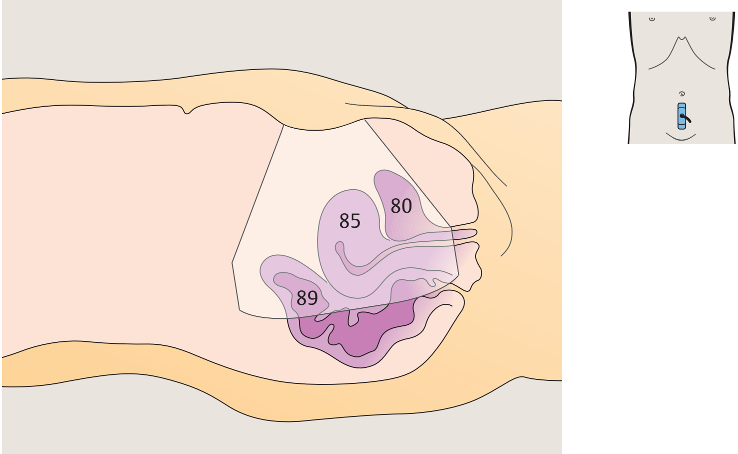
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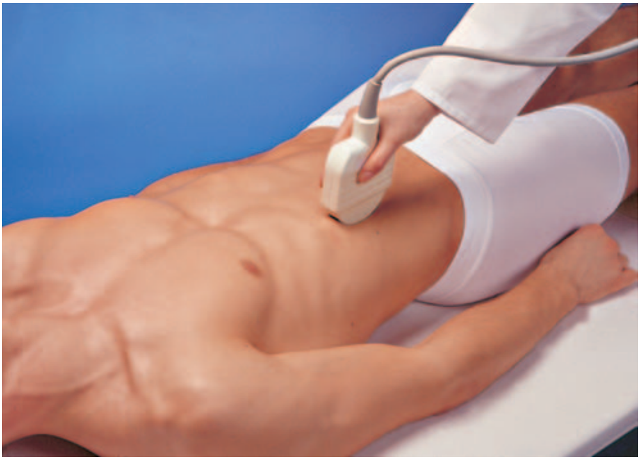

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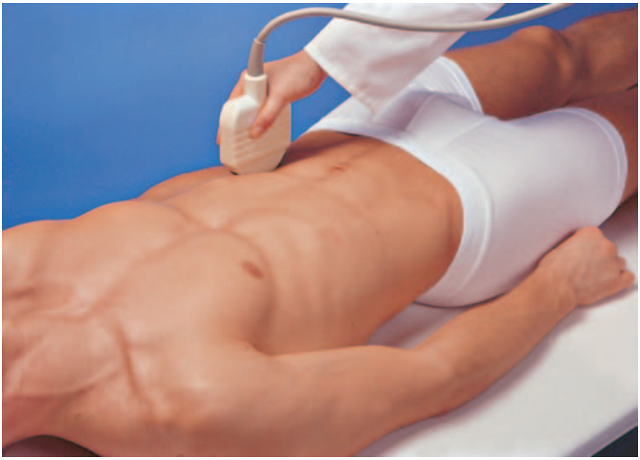

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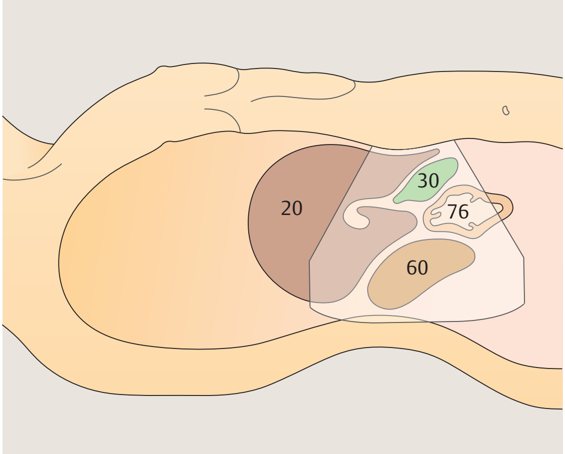
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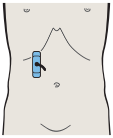

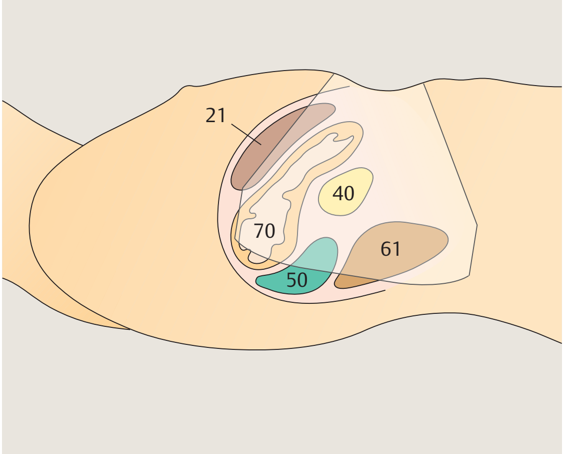
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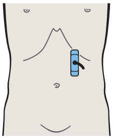

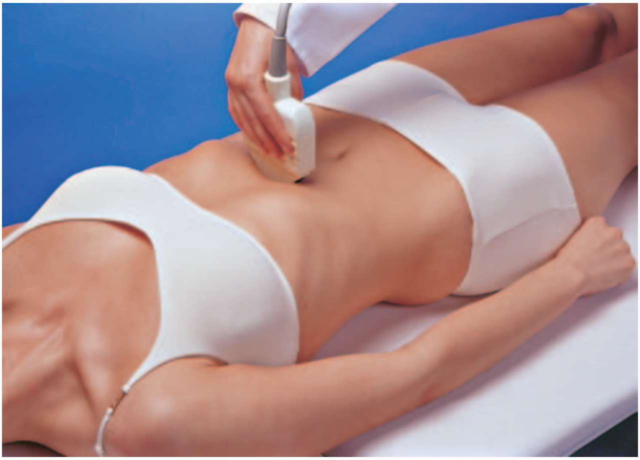

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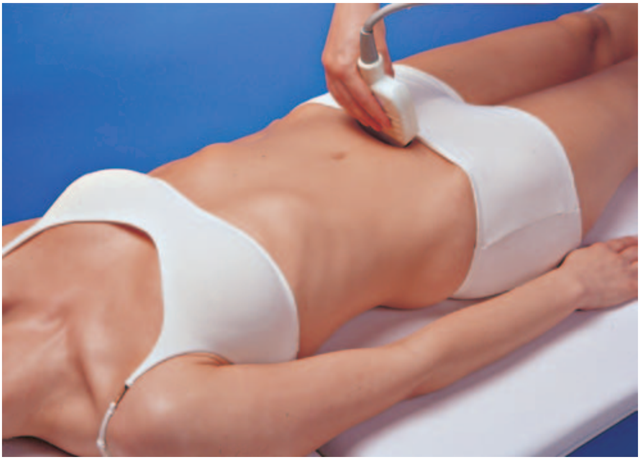

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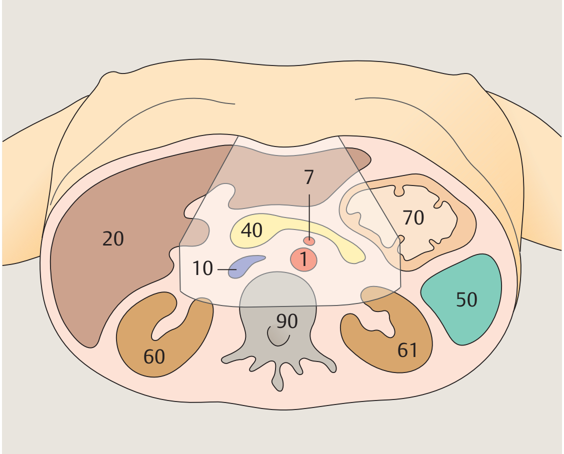
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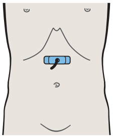

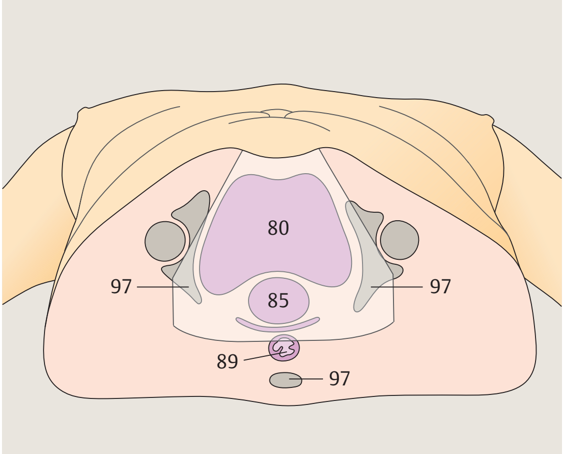
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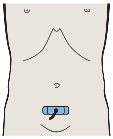

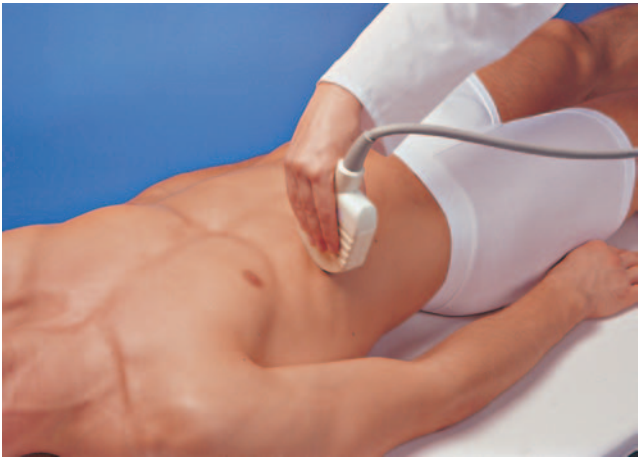

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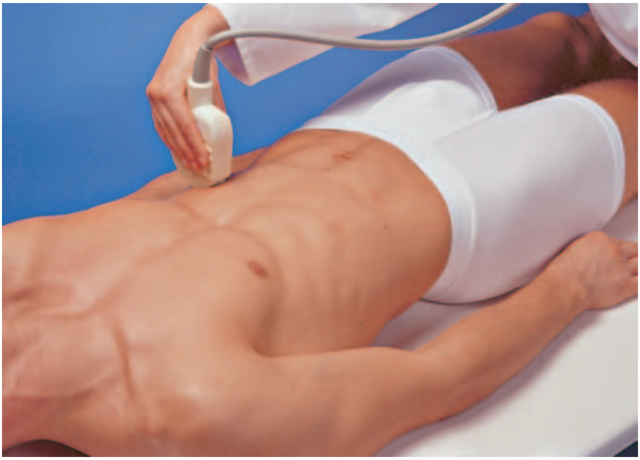

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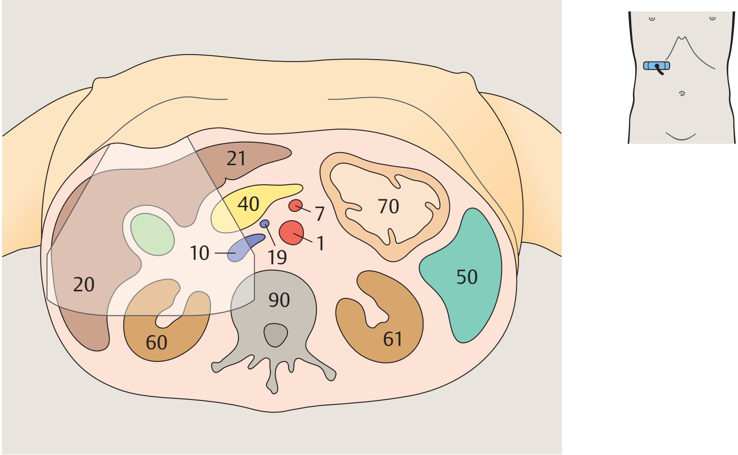
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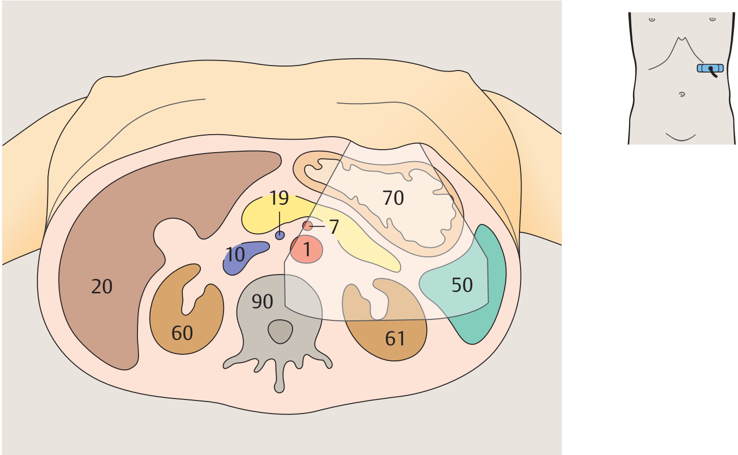
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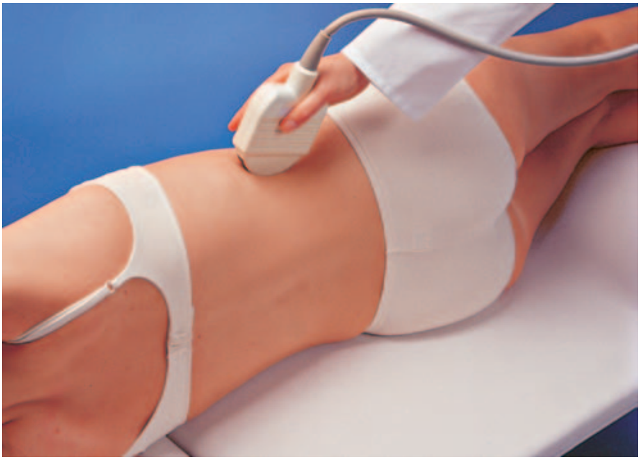

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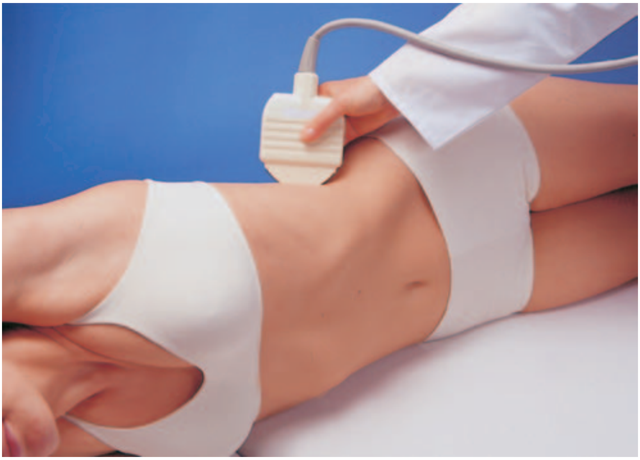

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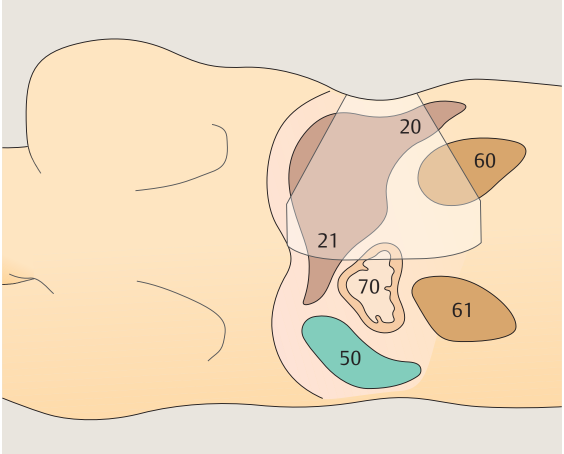
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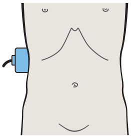

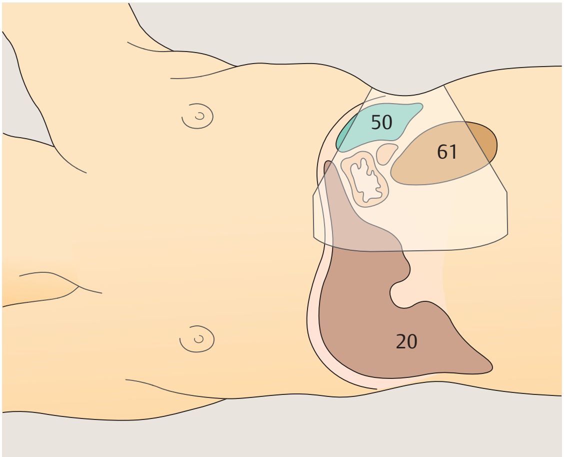
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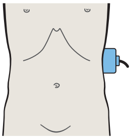

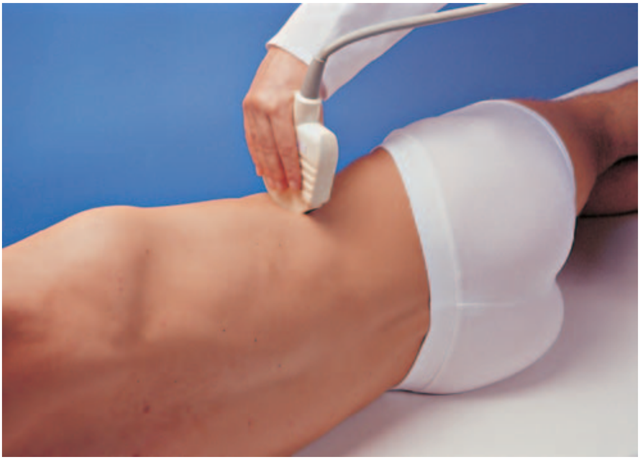

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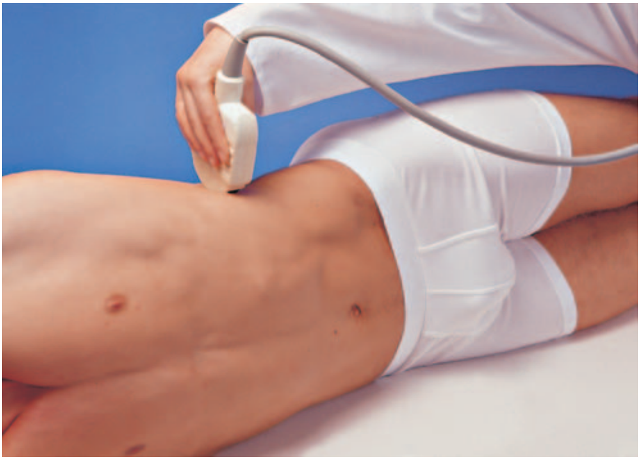

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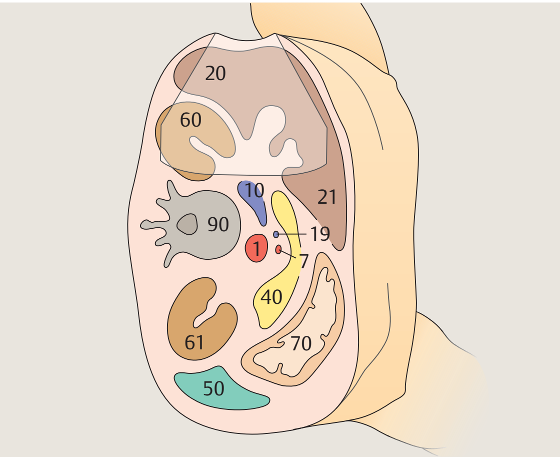
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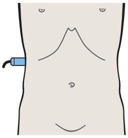

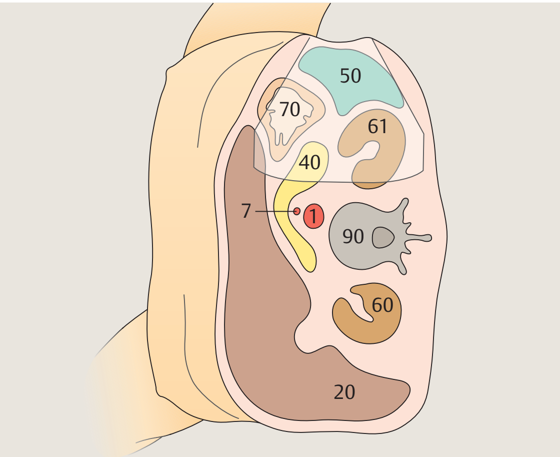
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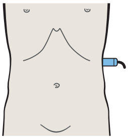

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13 Infrarenal aorta and vena cava
14 Infrarenal aorta, vena cava, superior mesenteric artery and vein
15 Infrarenal aorta and vena cava
16 Aortic bifurcation
17 Iliac arteries
18 Confluence of iliac veins
19 Iliac vessels
20 Iliac vessels
21 Iliac vessels
22 Iliac vessels
23 Left iliac vessels
24 Left iliac vessels

Splenic Artery and Vein in Longitudinal Sections

25 Aorta
26 Splenic vein and left gastric artery
27 Splenic artery and vein, celiac trunk
28 Splenic artery and vein, celiac trunk
29 Splenic artery and vein, renal artery and vein
30 Splenic artery and vein, renal artery and vein

Hepatic Artery in Longitudinal Sections

31 Celiac trunk
32 Hepatic artery and splenic vein
33 Hepatic artery and superior mesenteric vein
34 Hepatic artery and portal vein

Renal Artery and Vein in Longitudinal Sections

35 Aorta
36 Right renal artery and left renal vein
37 Vena cava and right renal artery
38 Right renal artery and right renal vein

Right Renal Artery and Vein in Transverse Sections

39 Opening of renal vein
40 Renal vein
41 Renal vein at hilum, renal artery
42 Renal artery

Left Renal Artery and Vein in Longitudinal Sections

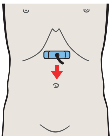
43 Vena cava
44 Right renal artery and left renal vein
45 Aorta and left renal vein
46 Left renal vessels, splenic artery and vein

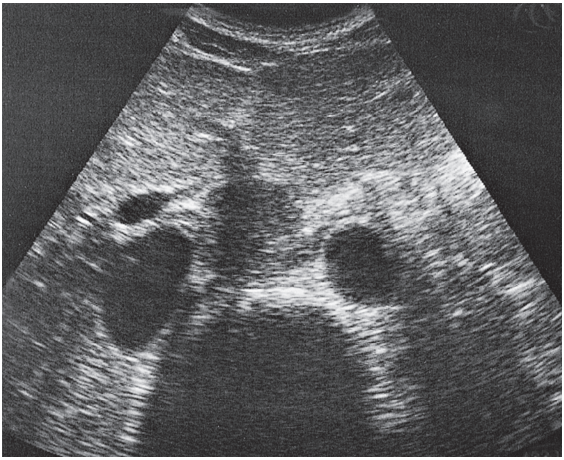
Vessels of the Porta Hepatis in Longitudinal Sections

47 Portal vein, vena cava, right renal artery
48 Portal vein, vena cava, right renal artery, and bile duct
49 Portal vein, vena cava, and bile duct
50 Portal vein and hepatic artery
51 Hepatic artery, superior mesenteric vein
52 Hepatic artery, superior mesenteric artery, and splenic vein

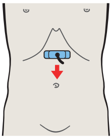
Vessels of the Porta Hepatis in Transverse Sections

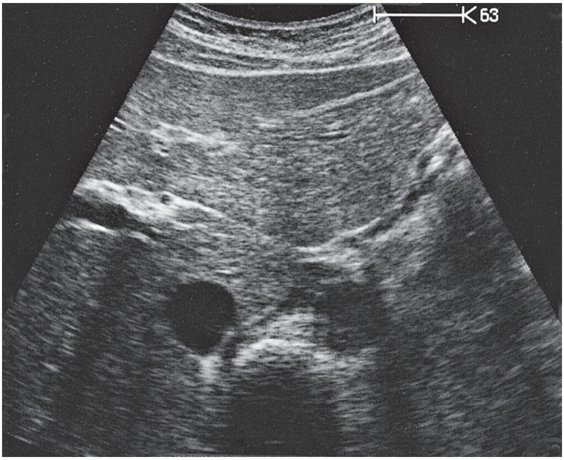
53 Hepatic artery, portal vein, vena cava
54 Hepatic artery, bile duct, portal vein
55 Bile duct, gallbladder, vena cava
56 Bile duct, gallbladder, superior mesenteric vein



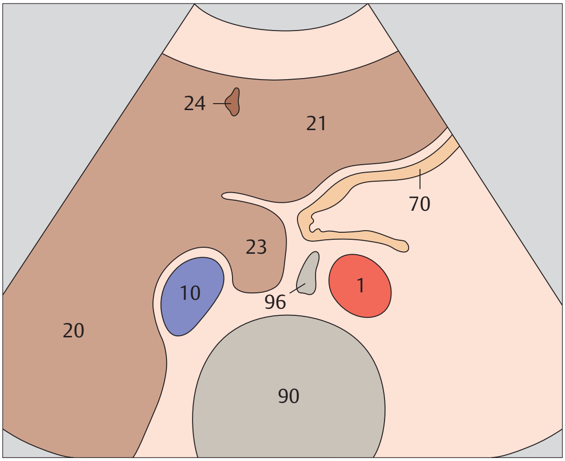


▶ **1** Passage of aorta and vena cava through diaphragm





▶ **2** Left gastric artery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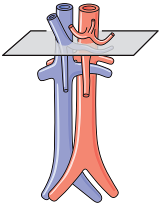
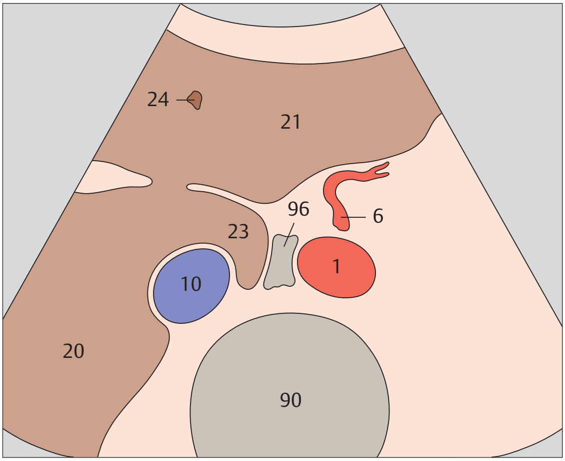


Just below the diaphragm, the vena cava is surrounded by liver tissue. The aorta lies directly behind the gastroesophageal junction, often making the vessel more difficult to scan.

◀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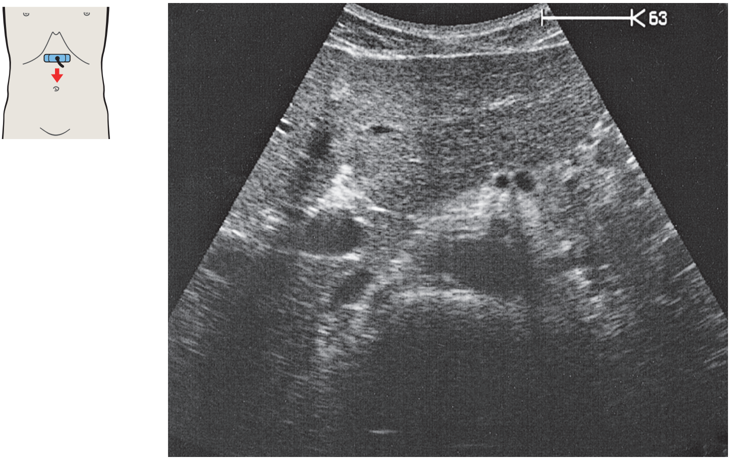
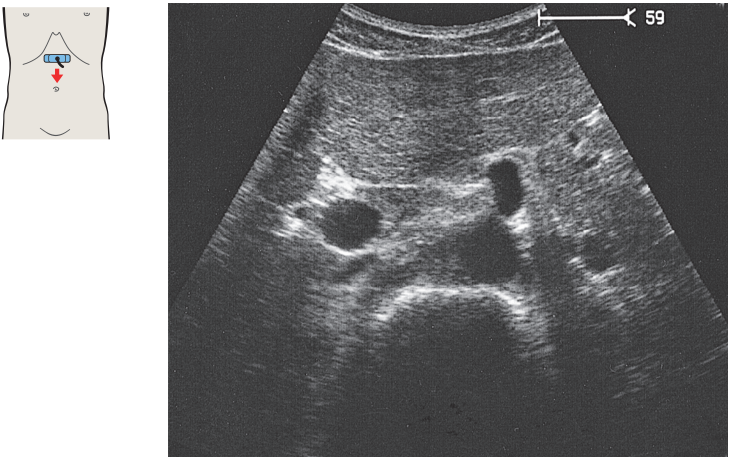
The left gastric artery is identified as a small-caliber vessel cranial to the celiac trunk.

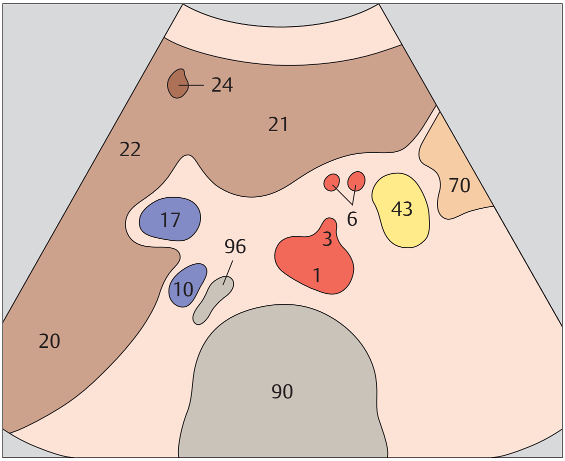
◀



▶ **3** Celiac trunk



▶ **4** Celiac trunk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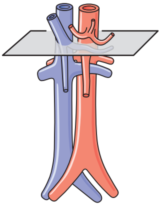
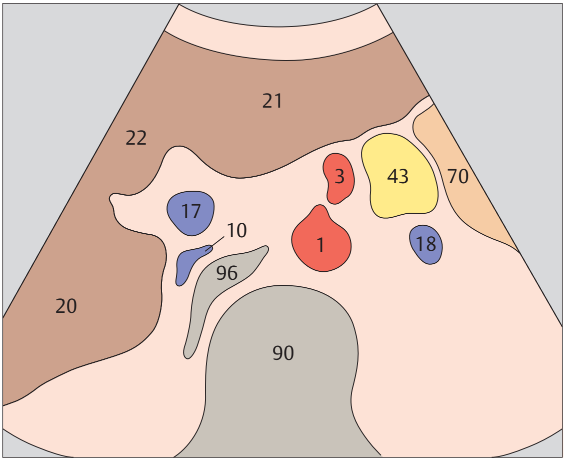


After arising from the aorta, the celiac trunk runs a short distance to the left.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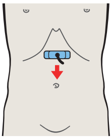
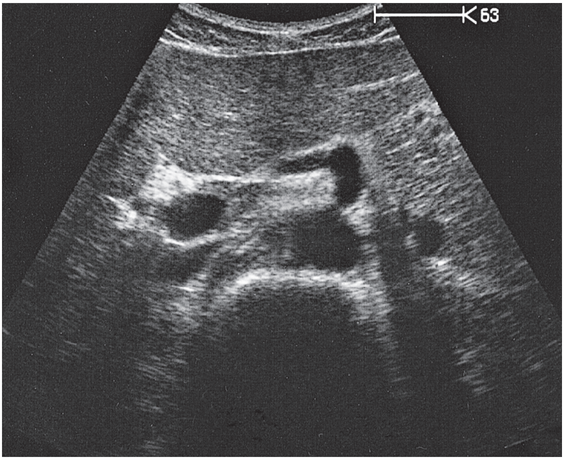
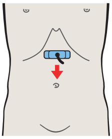
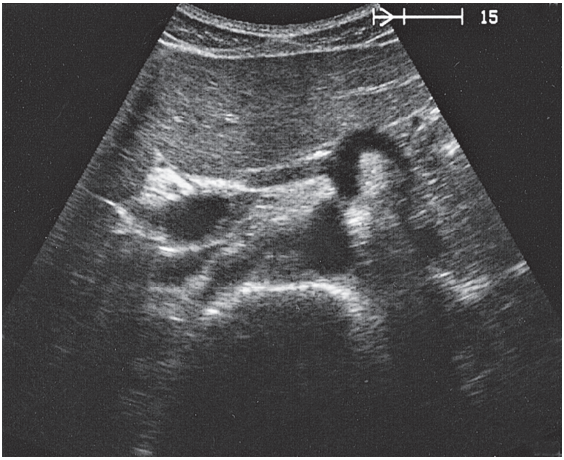
The proximal part of the celiac trunk also turns slightly downward in most cases.



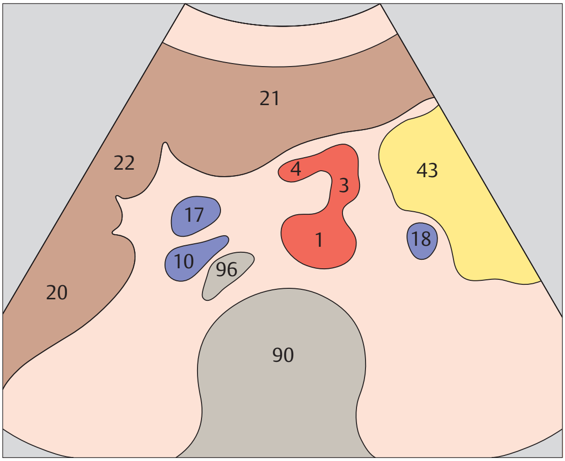


▶ **5** Hepatic artery





▶ **6** Splenic artery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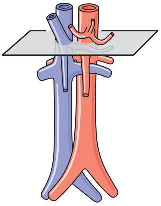
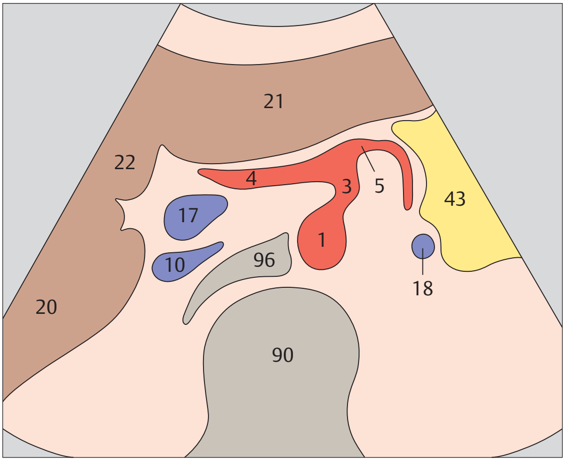


The celiac trunk runs slightly to the right, giving rise to the hepatic artery.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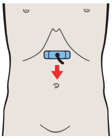
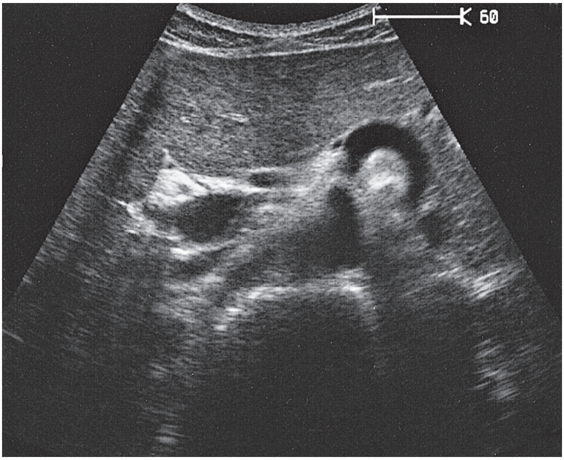
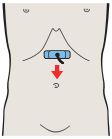
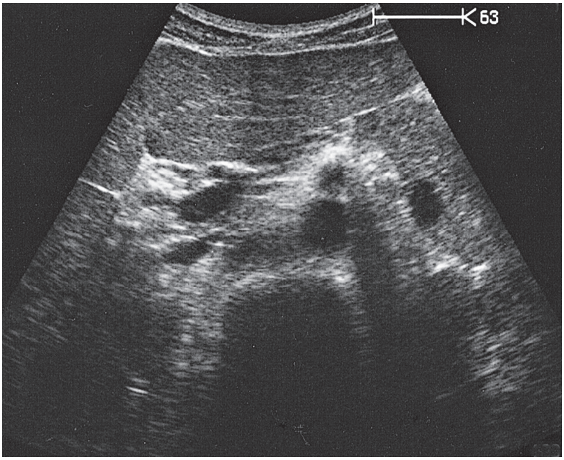
The splenic artery branches from the celiac trunk at a right angle.



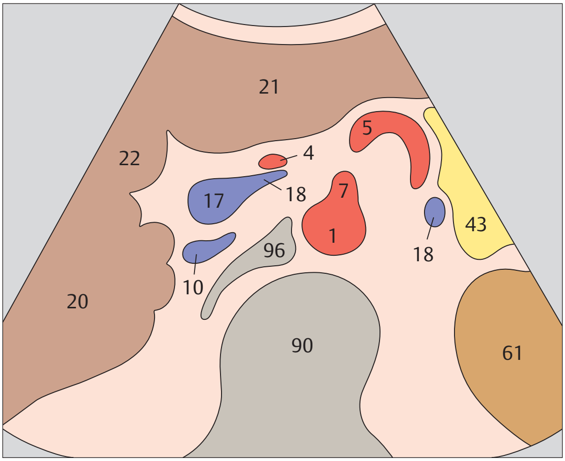


► **7** Superior mesenteric artery





► **8** Superior mesenteric artery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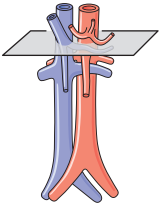
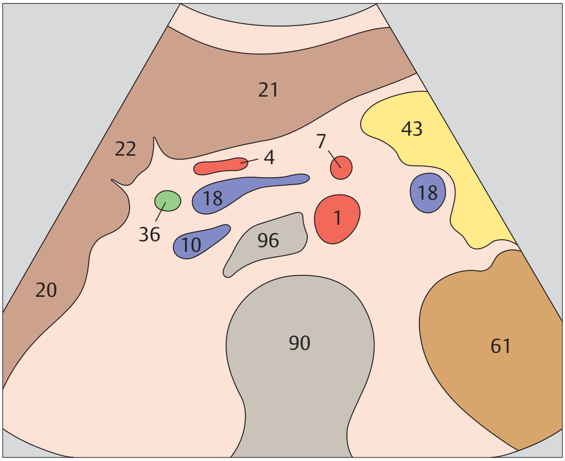


The superior mesenteric artery arises just below the celiac trunk and runs parallel to the aorta.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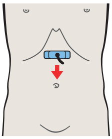
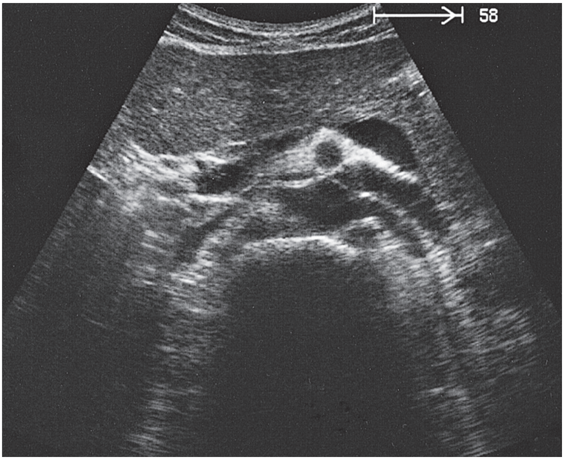
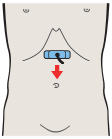
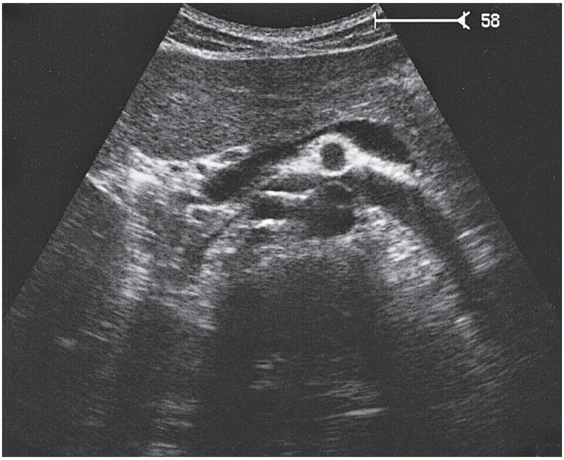
The root of the superior mesenteric artery is usually surrounded by an echodense fat pad.



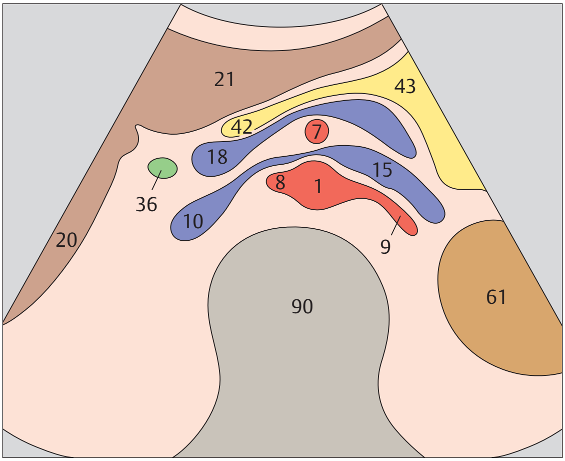


▶ **9** Superior mesenteric artery and splenic vein





▶ **10** Left renal vein and right renal artery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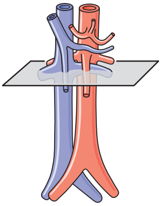
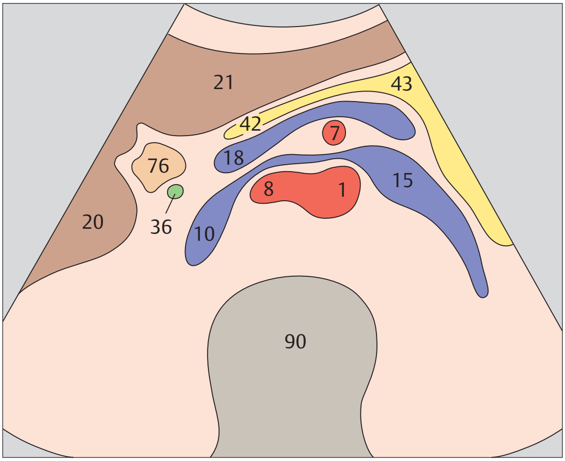


The aorta, the superior mesenteric artery, and the splenic vein crossing over the superior mesenteric artery provide landmarks for identifying the head of the pancreas.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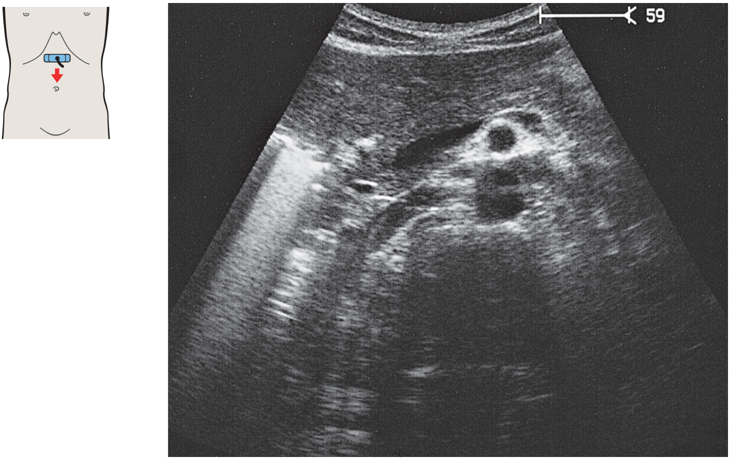
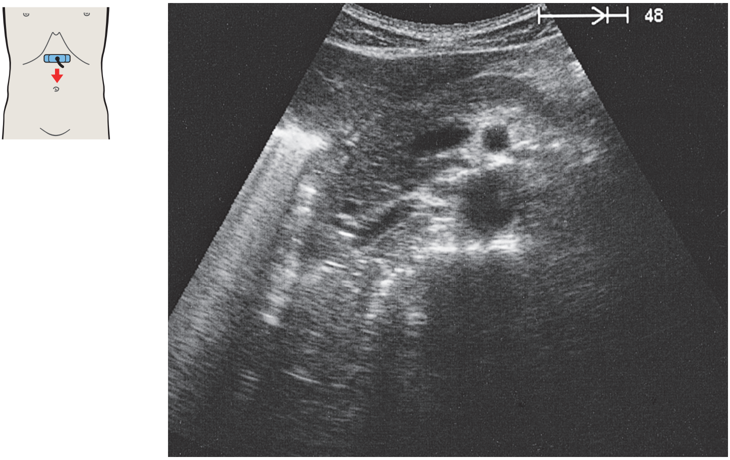
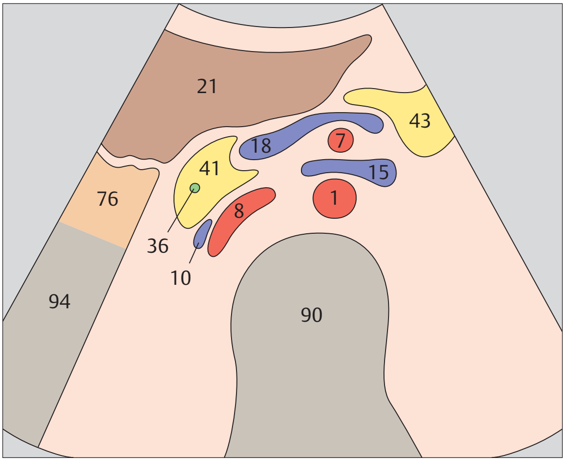
The left renal vein is physiologically compressed between the aorta and the superior mesenteric artery. It is slightly congested proximal to the compression site.



▶ **11** Infrarenal aorta and vena cava



▶ **12** Infrarenal aorta and vena cava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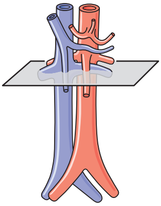
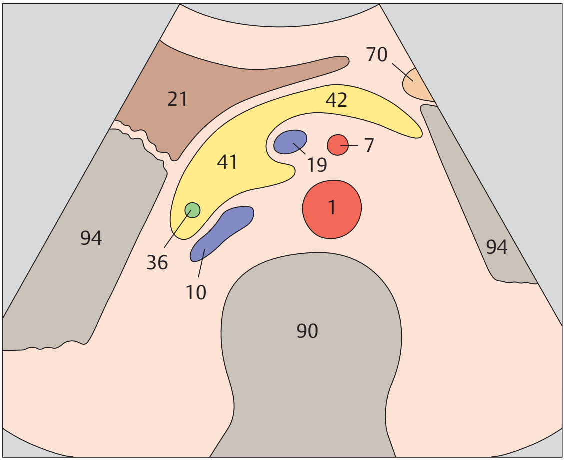


The vena cava is easily compressible with the transducer, and it bears impressions from adjacent organs. ◀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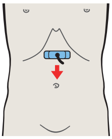
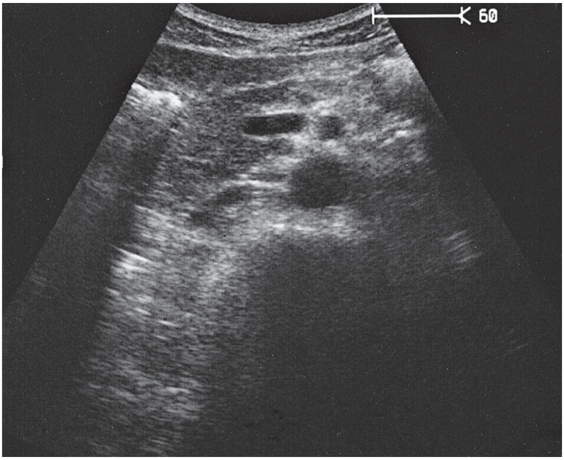
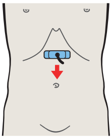
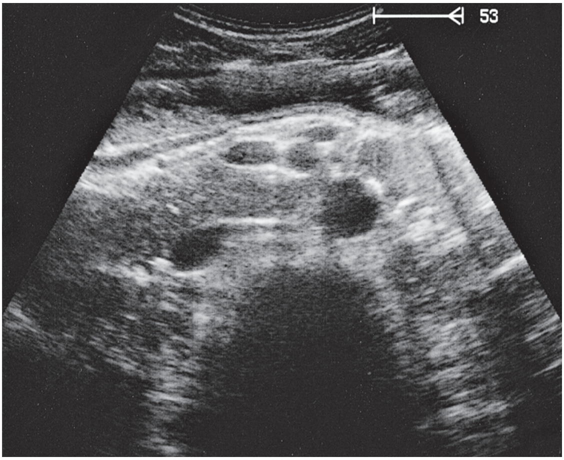
The aorta has a circular cross section, whereas the vena cava is somewhat flattened. ◀



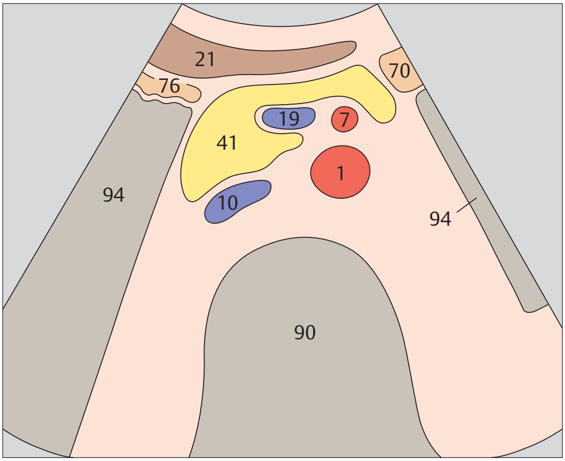


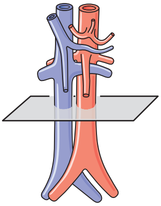
▶ **13** Infrarenal aorta and vena cava



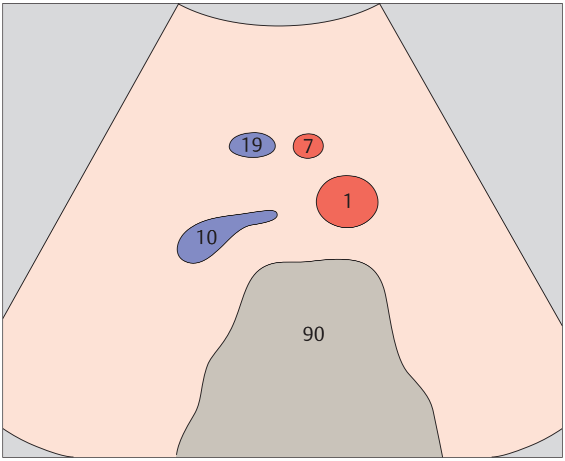


▶ **14** Infrarenal aorta, vena cava, and superior mesenteric artery and vein

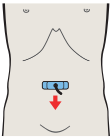


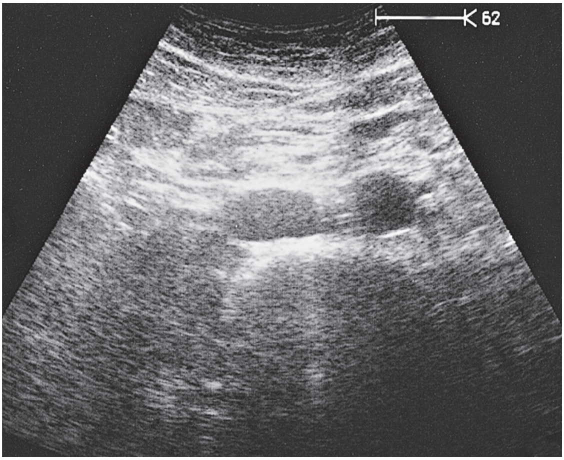


The caliber of the vena cava varies with the pulse and respirations. The diameter of the aorta measures 2.5 cm in its cranial portion, 2.0 cm in its caudal portion.

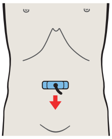


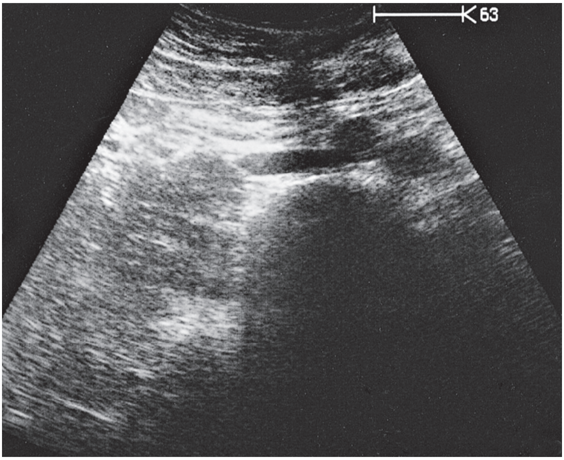
Together with the aorta and vena cava, the superior mesenteric artery and vein form a typical four-vessel pattern in a low transverse scan through the upper abdomen.



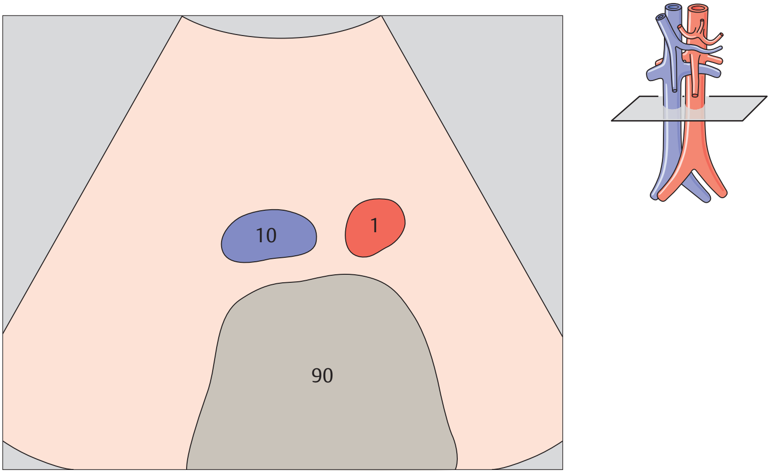


▶ **15** Infrarenal aorta and vena cava

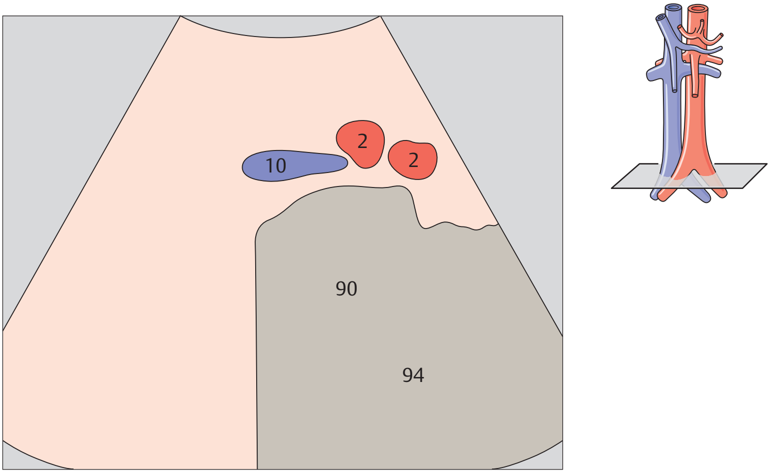




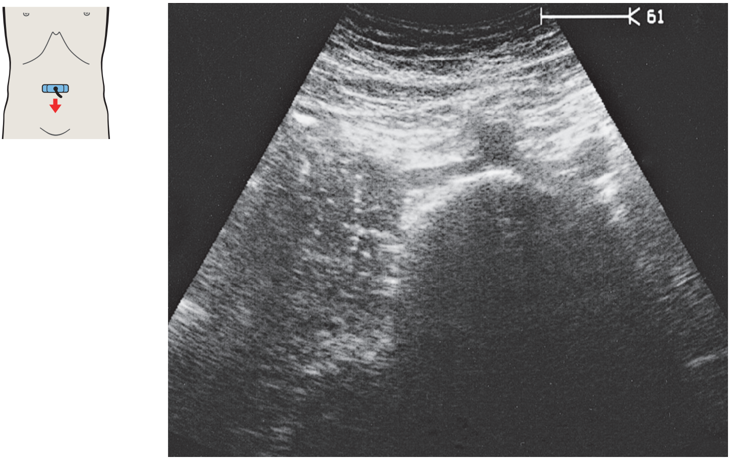
▶ **16** Aortic bifurcation



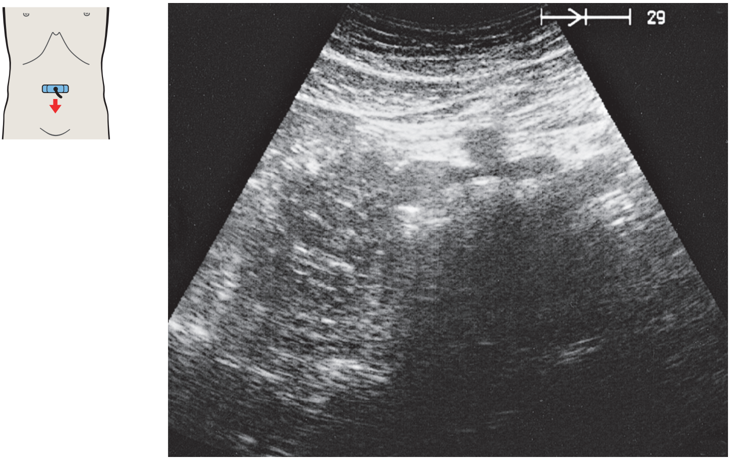
While the aorta and vena cava are relatively far apart in the upper abdomen, they converge at the level of the promontory, coming very close together.



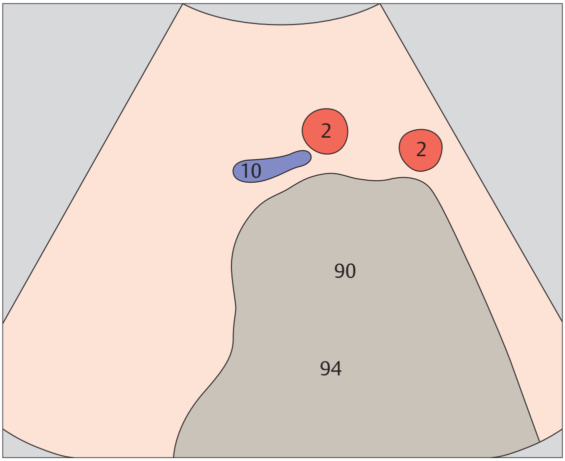
The aorta divides into the common iliac arteries at the level of the L4 vertebral body, above the promontory.

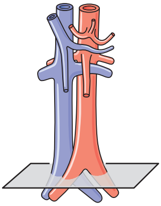


▶ **17** Iliac arteries

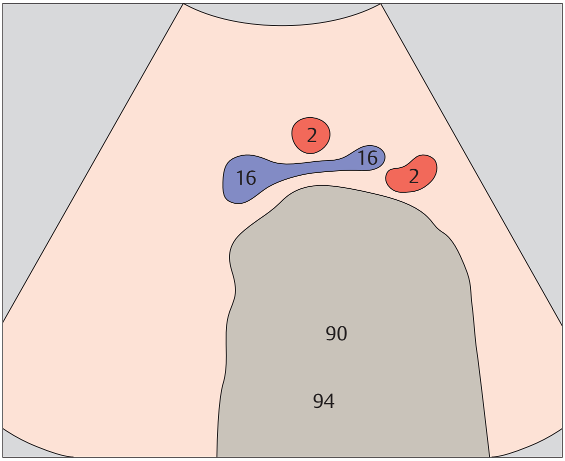


▶ **18** Confluence of iliac veins

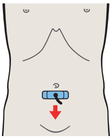


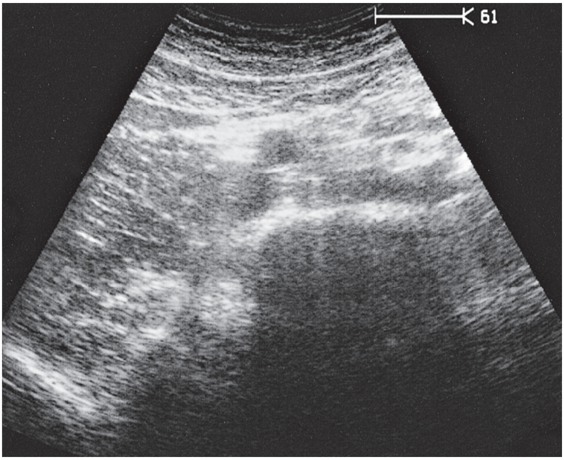


The aortic bifurcation is located slightly above the confluence of the iliac veins. ◄

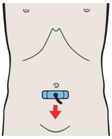


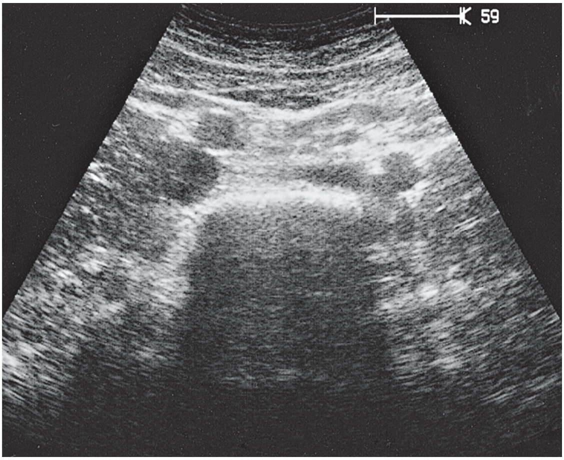
The confluence of the iliac veins lies approximately at the level of the umbilicus. ◄



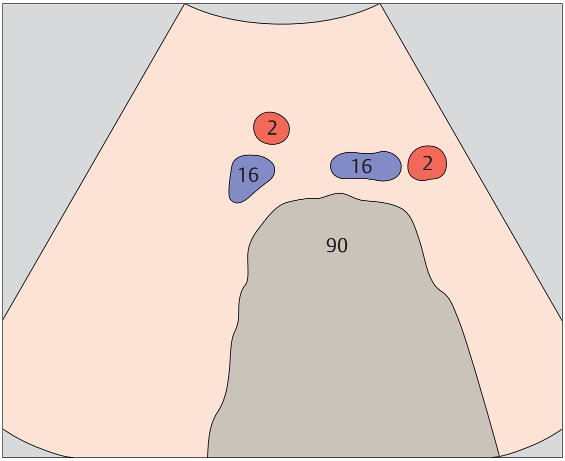


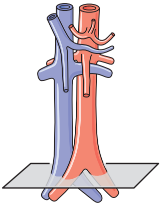
▶ **19** Iliac vessels



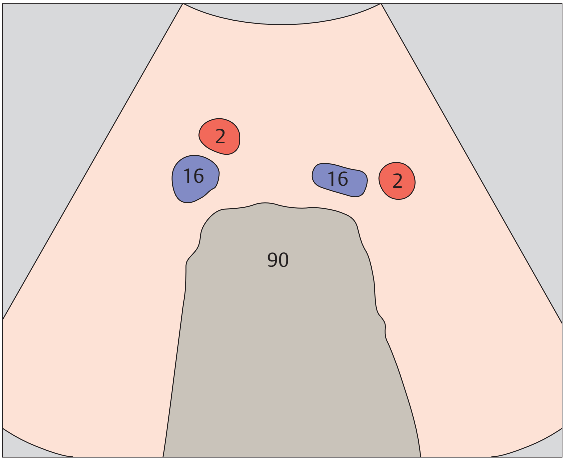


▶ **20** Iliac vessels

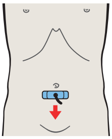


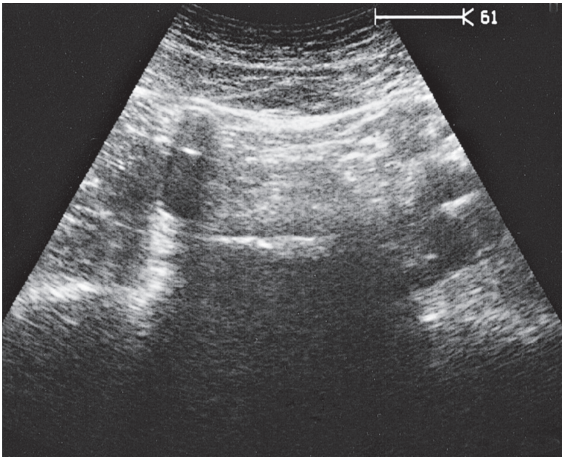


The iliac arteries are first anterior and then lateral to the iliac veins. ◀

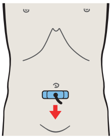


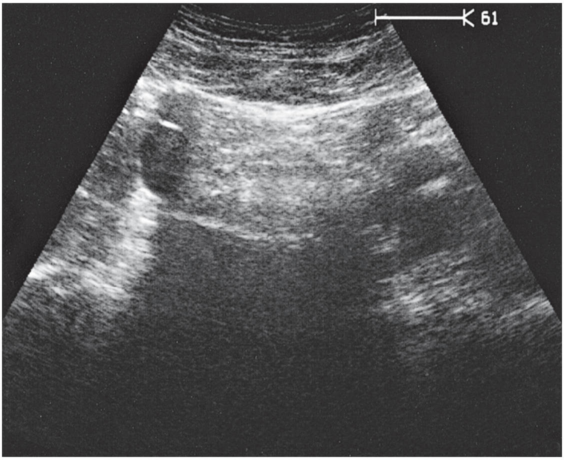
The iliac vessels follow the concavity of the lesser pelvis to the femoral arteries. ◀



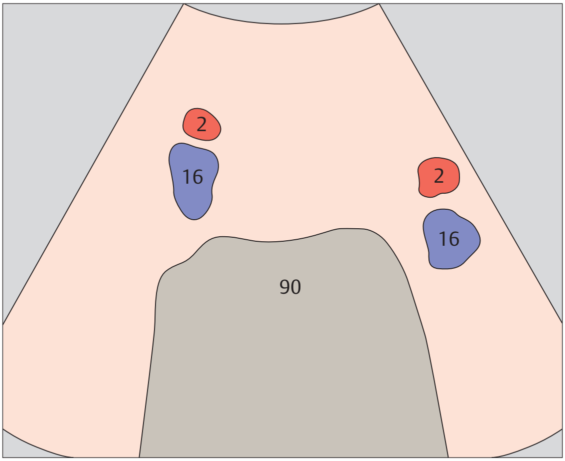


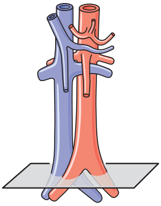
▶ **21** Iliac vessels



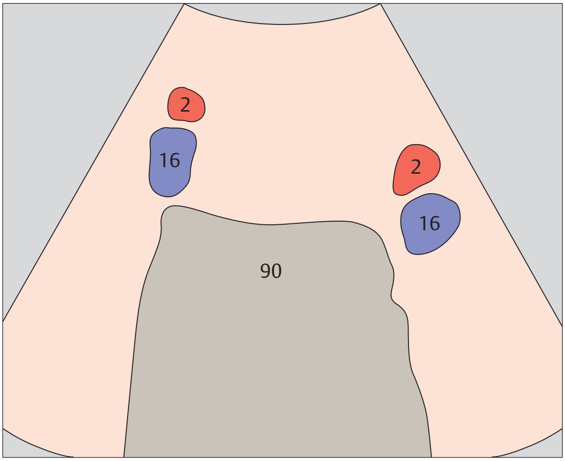


▶ **22** Iliac vessels

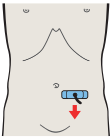


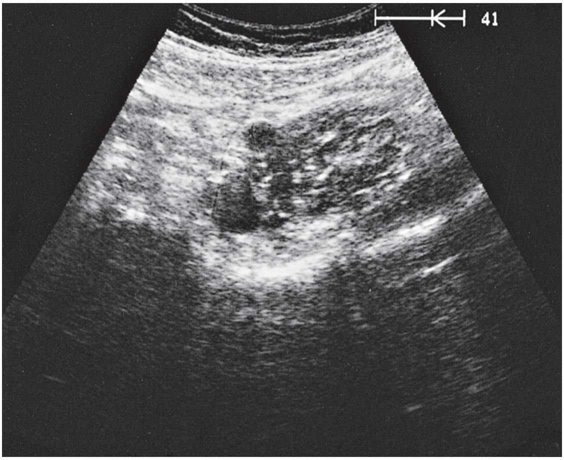


In serial transverse scans down the iliac vessels, the sections of the vessels are seen to move laterally and posteriorly. ◄

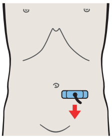


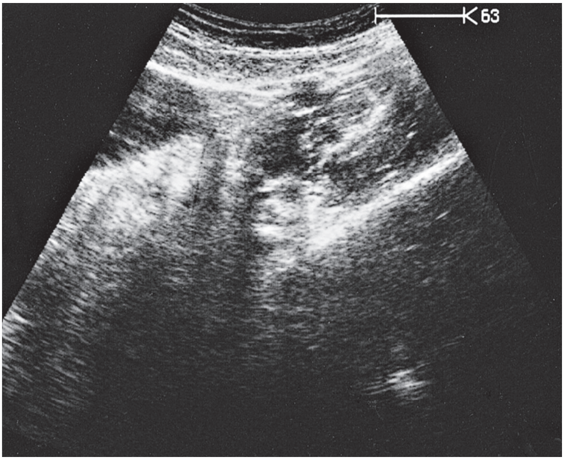
The iliac vessels are more difficult to scan at lower levels due to intervening bowel gas. ◄



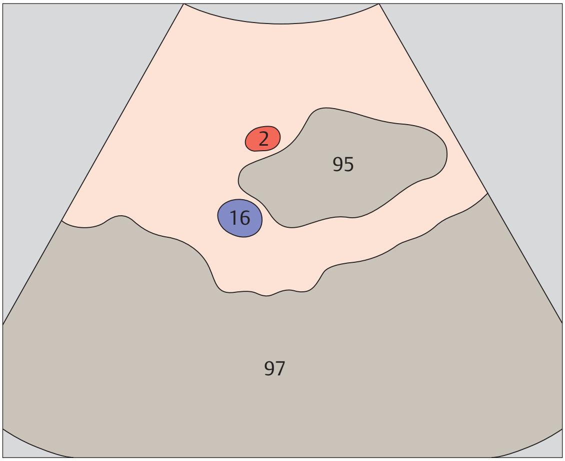


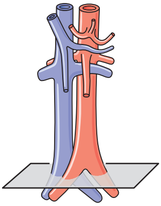
▶ **23** Left iliac vessels



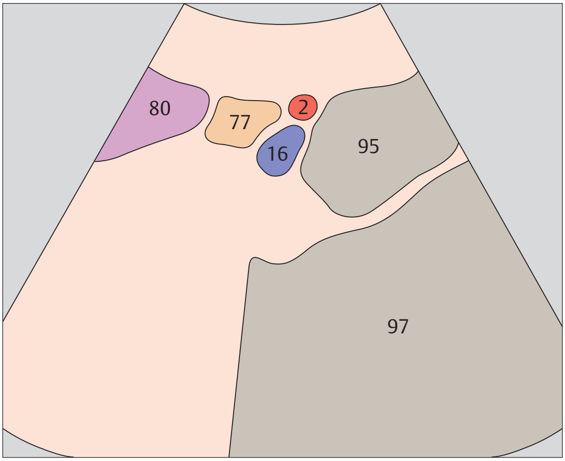


▶ **24** Left iliac vessels

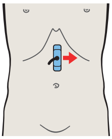


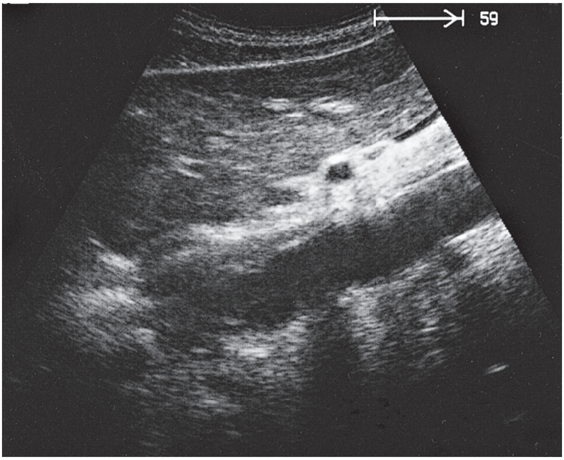


The iliac veins run dorsomedial to the iliac arteries in the lesser pelvis. ◀

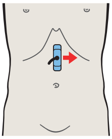


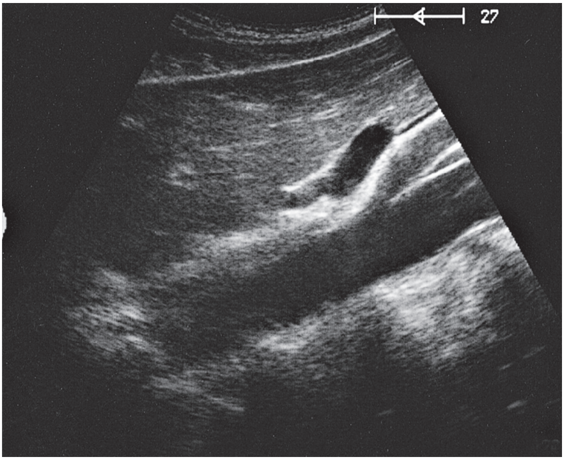
The iliac veins are always medial to the arteries at the level of the inguinal ligament. ◀



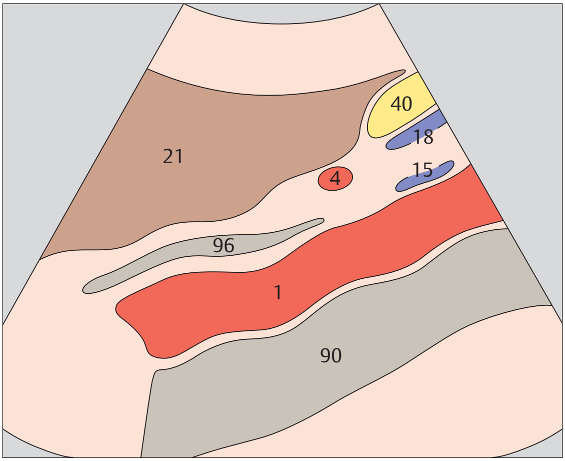


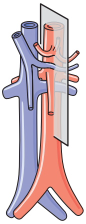
▶ **25** Aorta



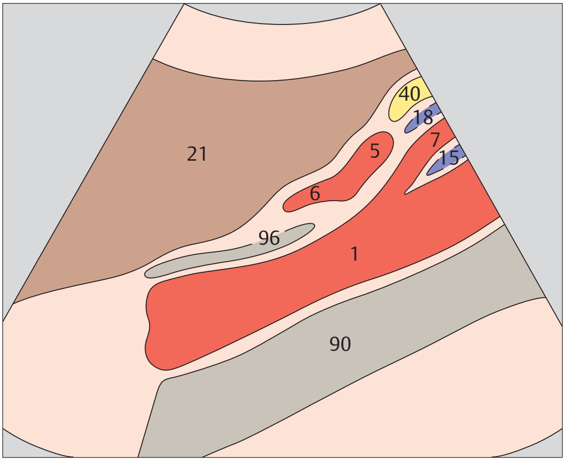


▶ **26** Splenic artery and left gastric artery


40
18
21
4
15
96
1
90



Because the celiac trunk runs slightly to the left initially, often it is not displayed in a longitudinal scan centered over the aorta. ◀


40
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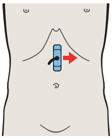
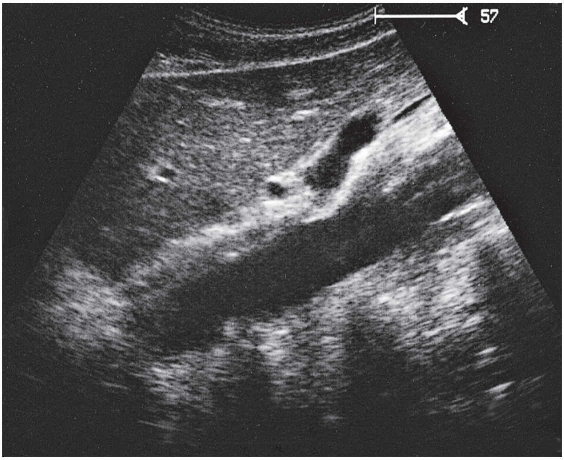
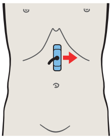
1
90

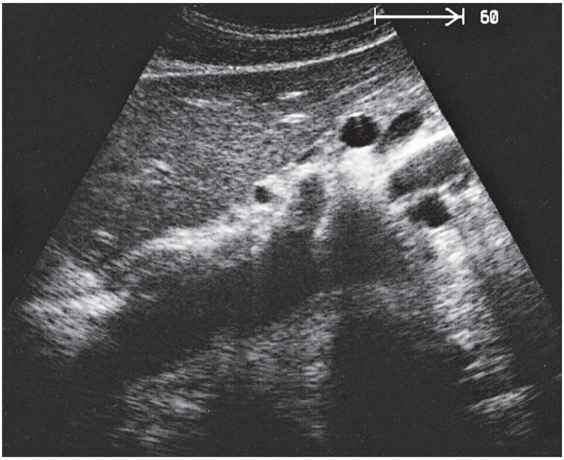
The left gastric artery runs cranially between the common hepatic artery and splenic artery. It is often difficult to define. ◀



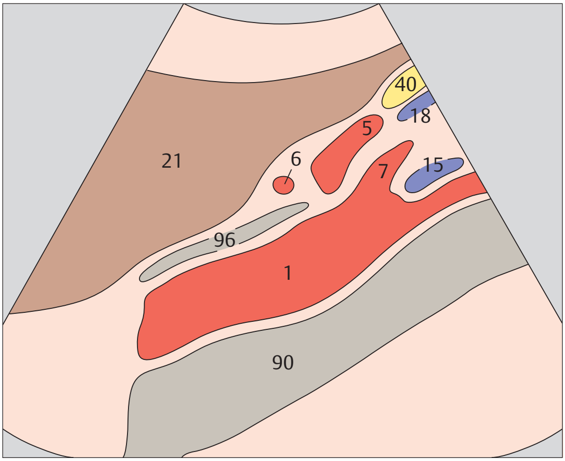


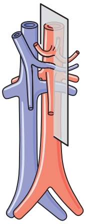
▶ **27** Splenic artery and vein, celiac trunk



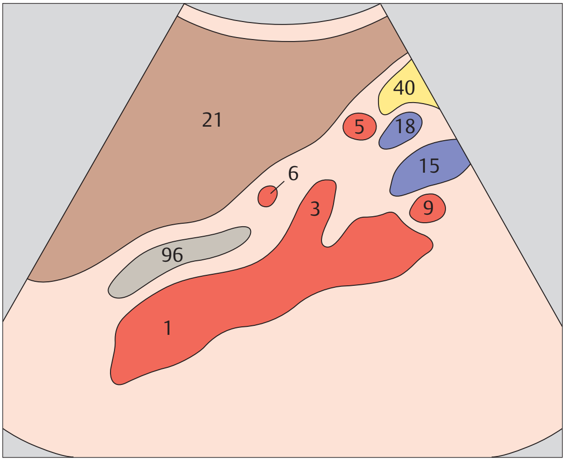


▶ **28** Splenic artery and vein, celiac trunk

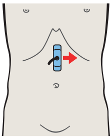

40
18
5
21
6
7
15
96
1
90

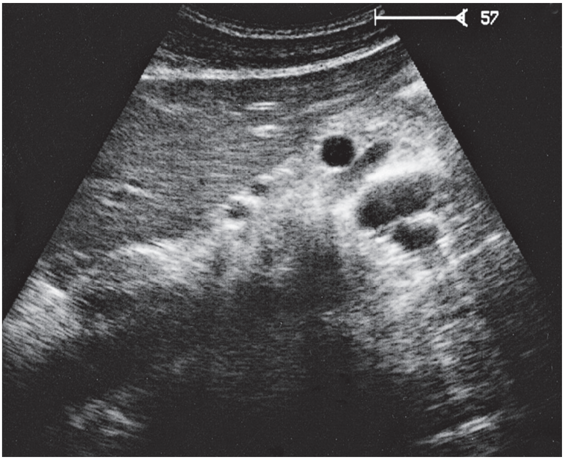


The celiac trunk divides into the left gastric artery, common hepatic artery, and splenic artery.

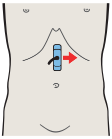

40
21
5
18
6
15
3
9
96
1

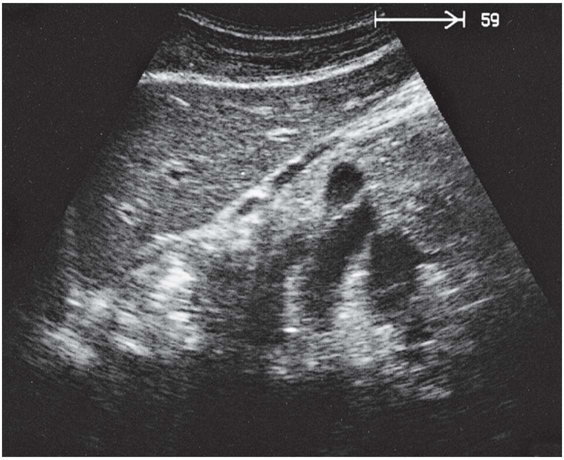
The curved course of the celiac trunk and splenic artery explains why both vessels appear in the same sagittal section.



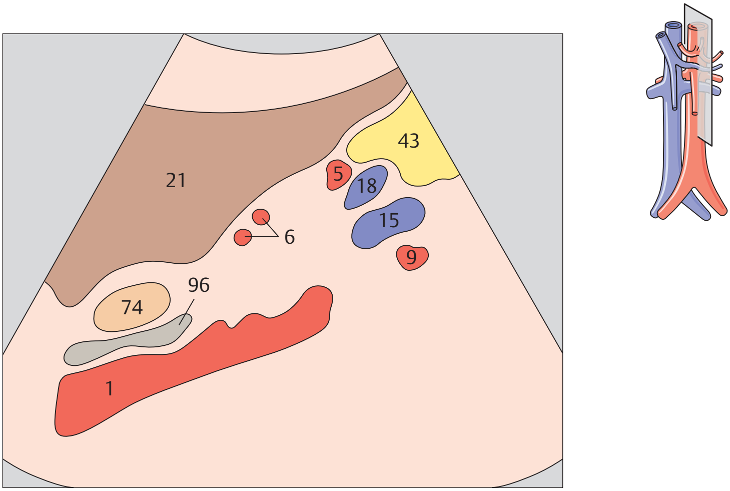


▶ **29** Splenic artery and vein, renal artery and vein

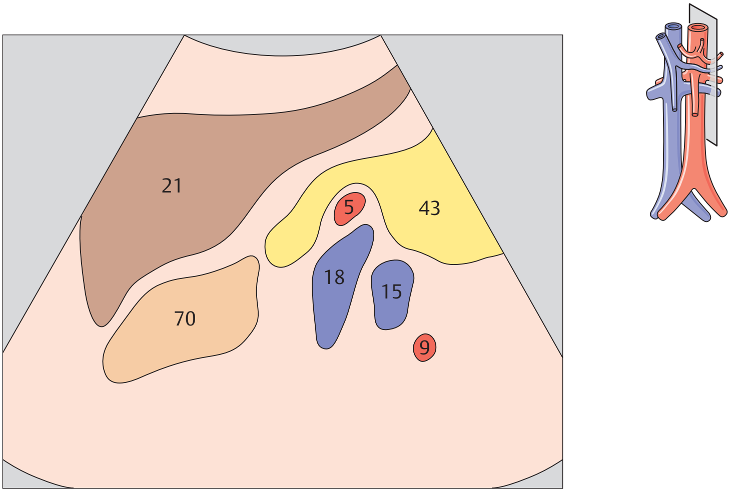




▶ **30** Splenic artery and vein, renal artery and vein


43
21
5
18
15
6
9
96
74
1

The splenic artery turns left and runs posteriorly with the splenic vein to the hilum of the spleen.


21
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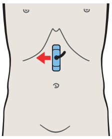
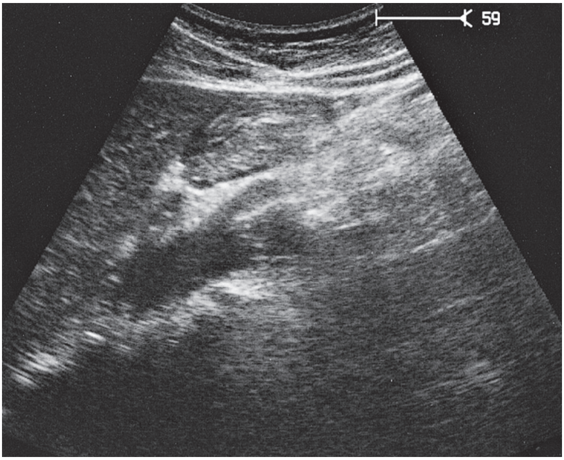
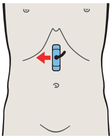
9

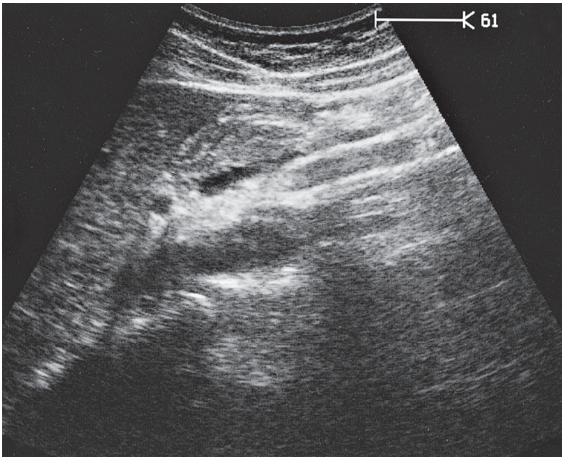
Longitudinal scan on the left side shows the typical appearance of the large splenic and renal veins and the smaller splenic and renal arteries.



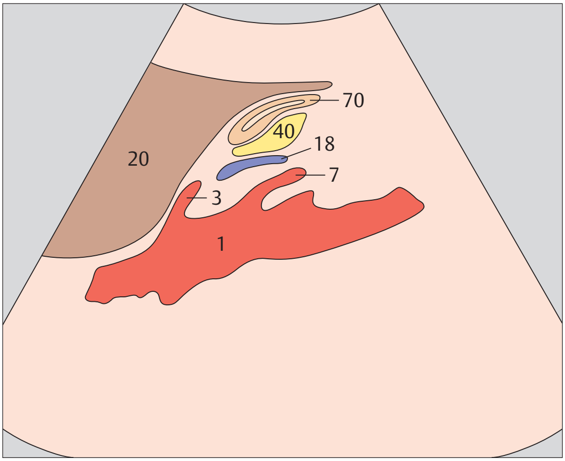


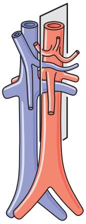
▶ **31** Celiac trunks



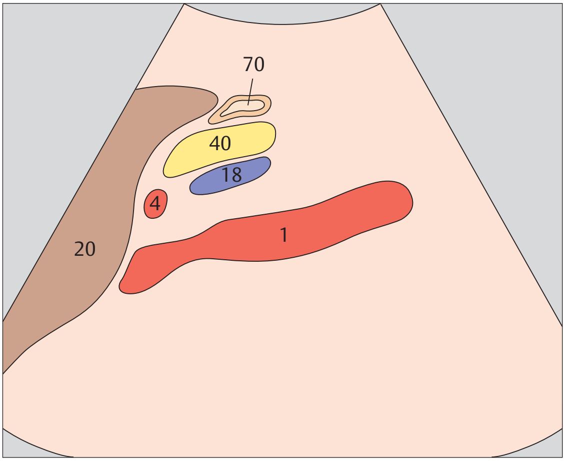


▶ **32** Hepatic artery and splenic vein

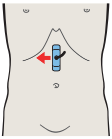


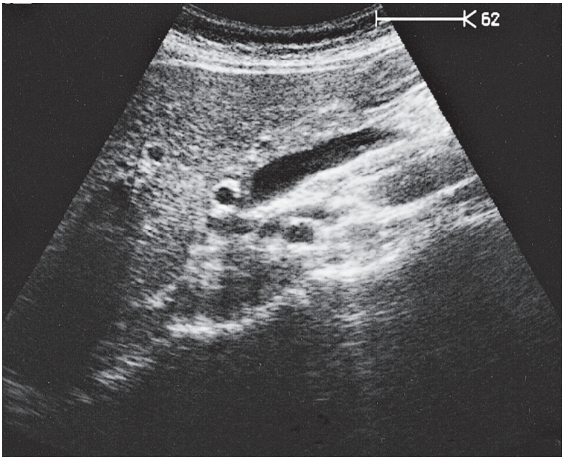


The origin of the celiac trunk and its division into branches are subject to numerous variations. ◀

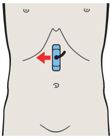


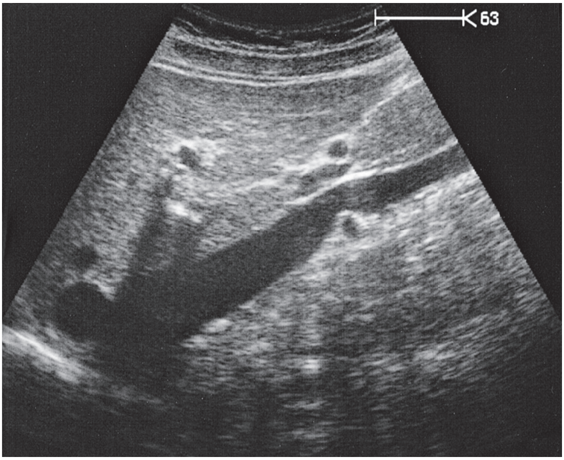
The hepatic artery turns upward and to the right and runs along the inferior border of the liver toward the porta hepatis. ◀



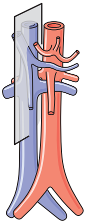


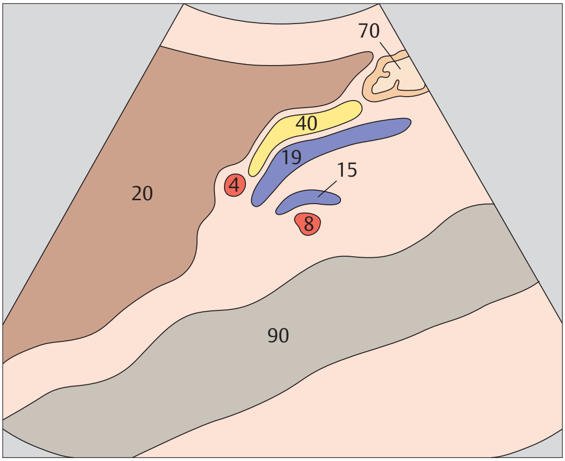
▶ **33** Hepatic artery and superior mesenteric vein



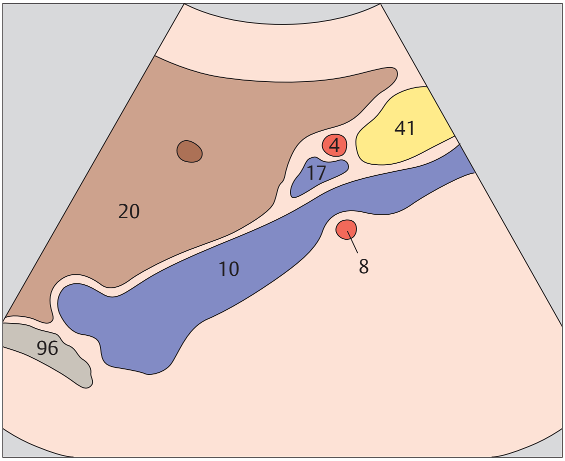


▶ **34** Hepatic artery and portal vein

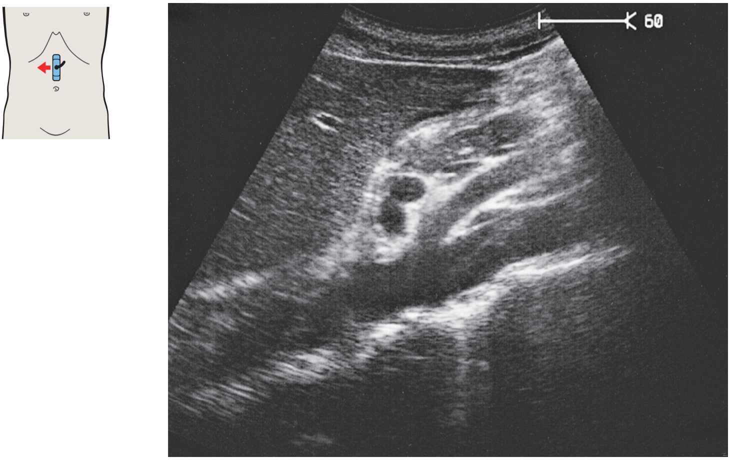




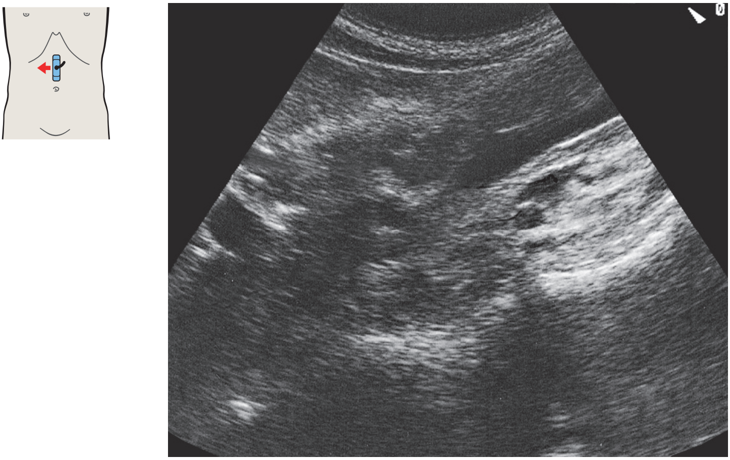
A longitudinal scan between the aorta and vena cava typically displays sections of four vessels: the hepatic artery, venous confluence, left renal vein, and right renal artery.



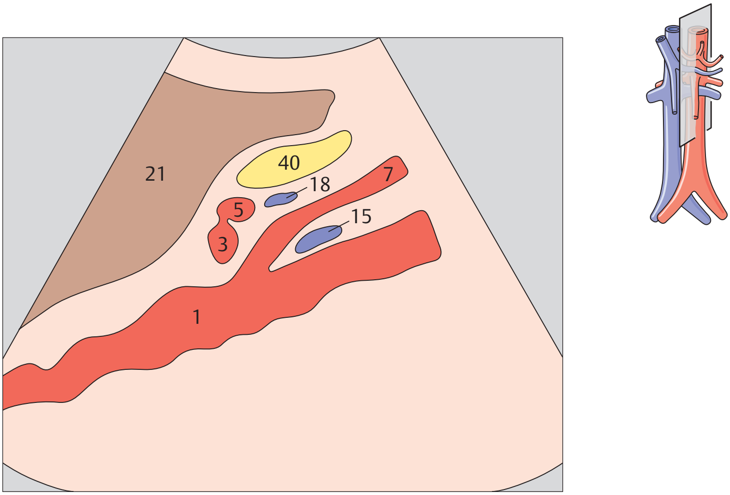
A longitudinal scan over the vena cava displays four typical vascular sections: the vena cava, portal vein, hepatic artery, and renal artery.



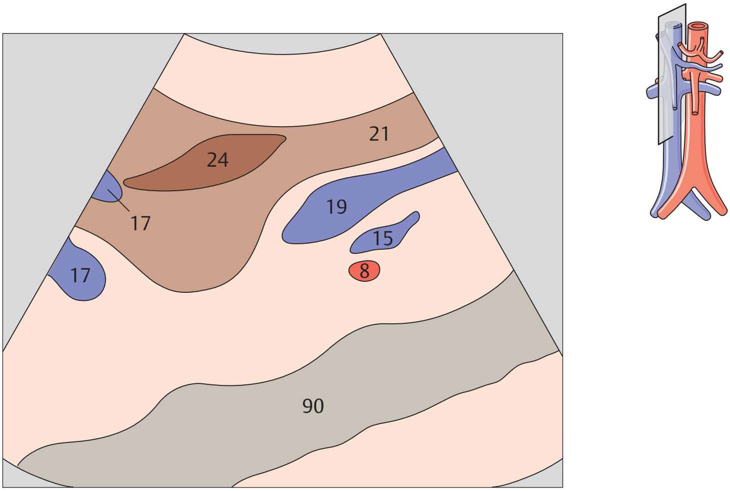
▶ **35** Aorta



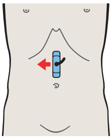
▶ **36** Right renal artery and left renal vein

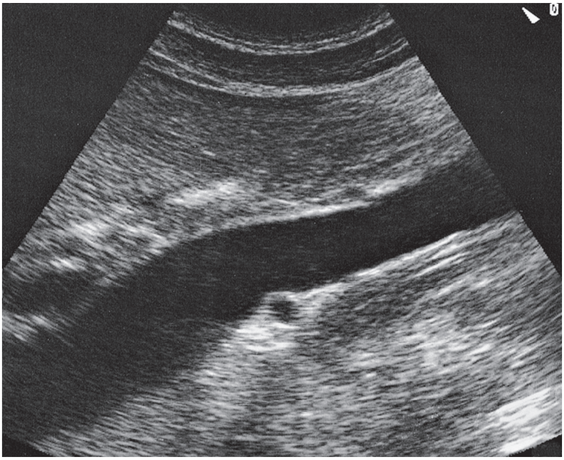


The left renal vein runs between the aorta and superior mesenteric artery, where it is subject to physiologic compression.

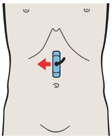


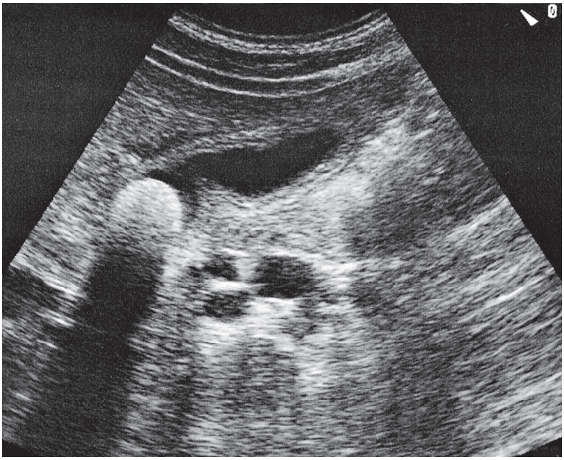
The section of the right renal artery can be identified between the aorta and vena cava. Just above the renal artery are the left renal vein and a longitudinal section of the superior mesenteric vein.



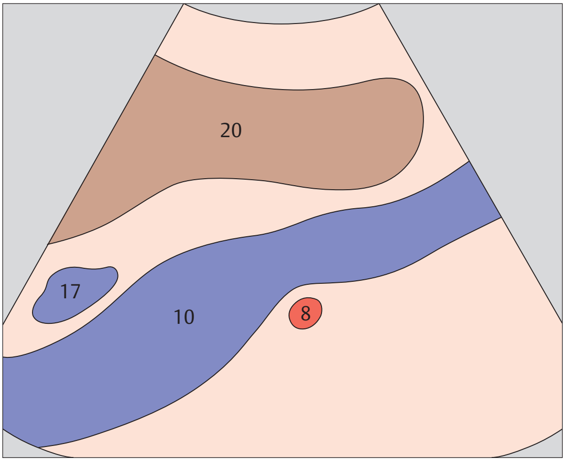


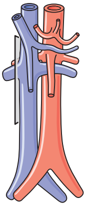
▶ **37** Vena cava and right renal artery



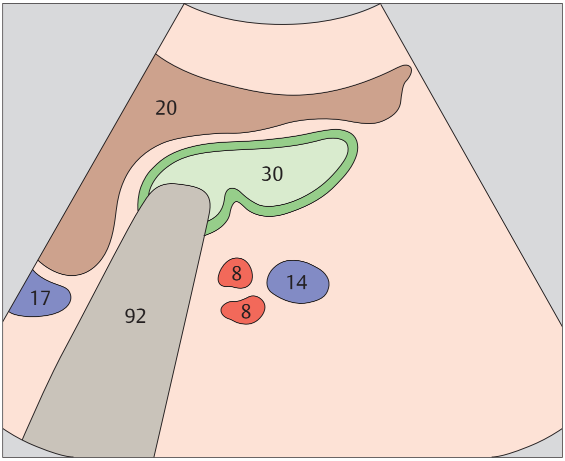


▶ **38** Right renal artery and right renal vein

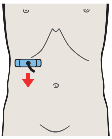


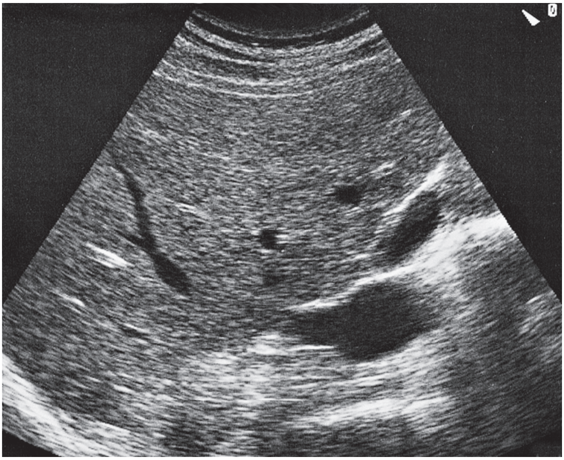


The right renal artery usually impresses the posterior surface of the vena cava, although variants may occur. ◀

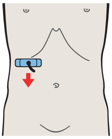


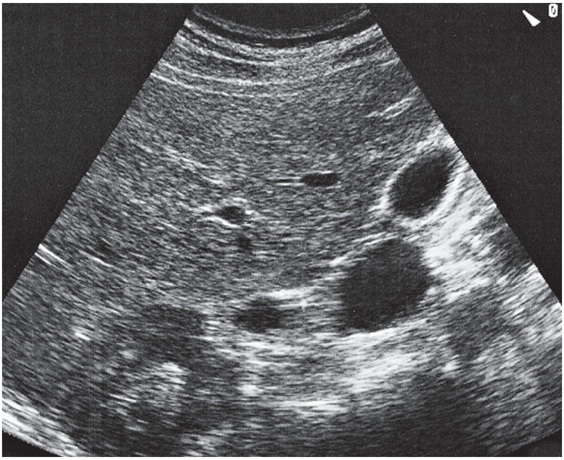
The renal veins are often more than twice the diameter of the renal arteries. ◀



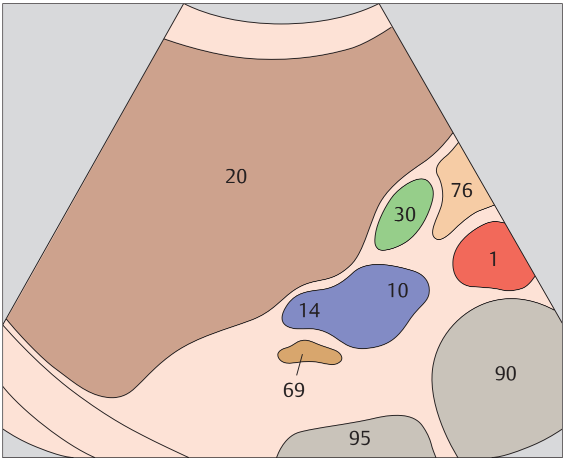


▶ **39** Opening of renal vein





▶ **40** Renal vein


20
76
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69
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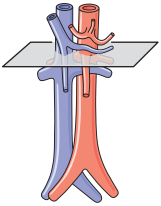
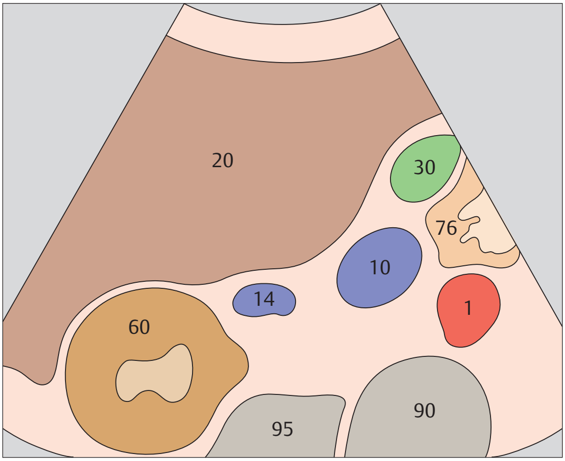


The opening of the right renal vein at the vena cava can be clearly defined above the kidney in most subjects.

◄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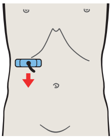
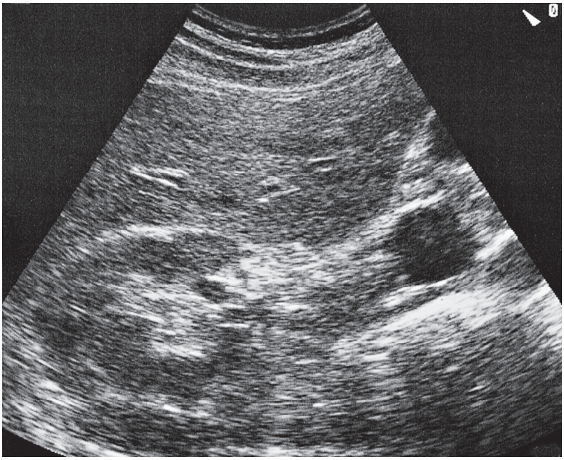
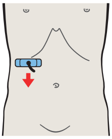
In serial transverse scans down the vena cava, the oval cross section of the renal vein separates from the vena cava and moves laterally toward the kidney.

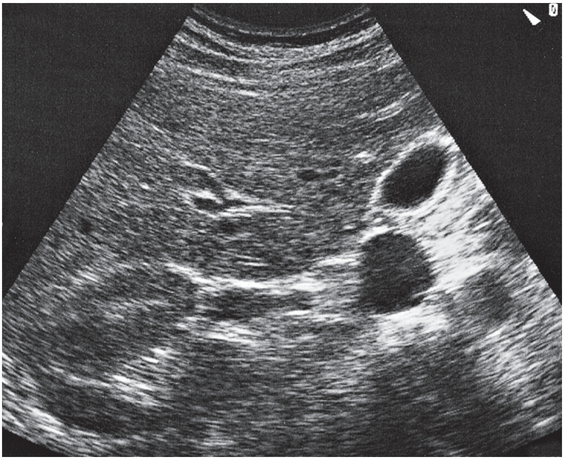
◄



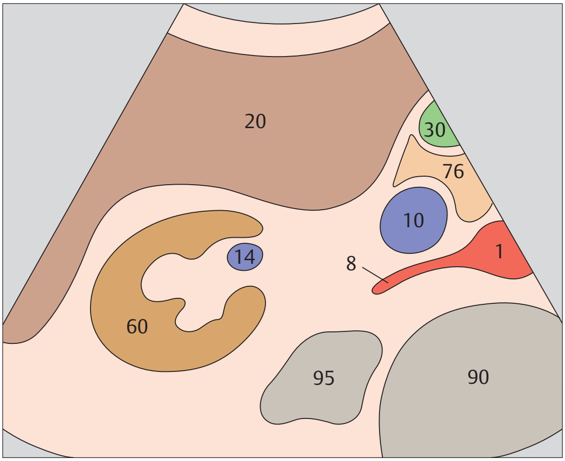


▶ **41** Renal vein at hilum, renal artery





▶ **42** Renal artery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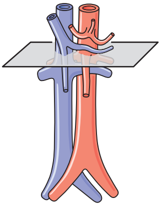
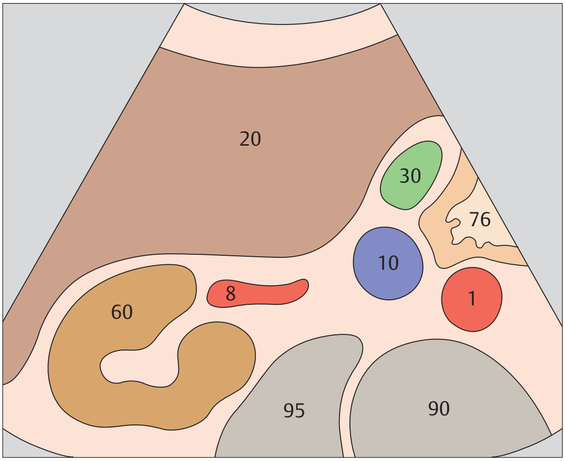


The renal artery follows the same course as the renal vein, but at a slightly more caudal level.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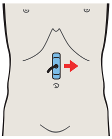
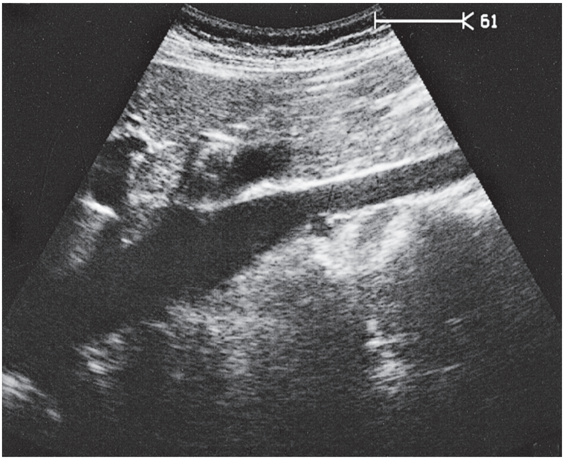
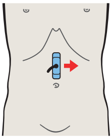
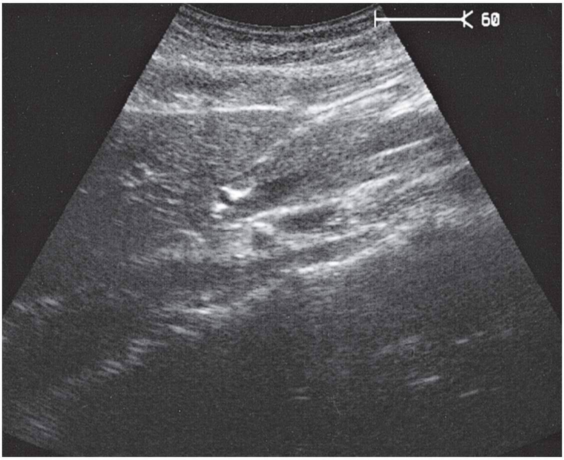
The renal arteries are located posterior and caudal to the renal veins.



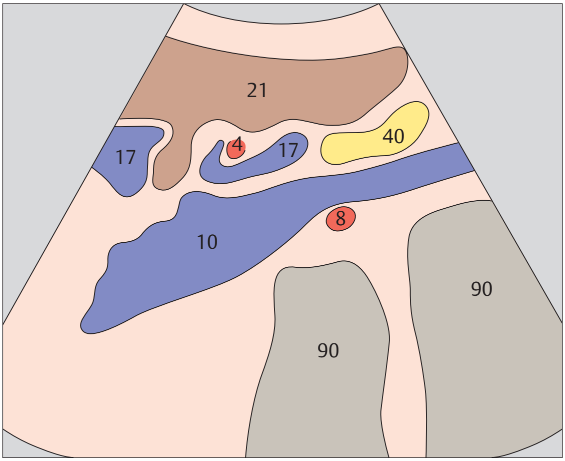


▶ **43** Vena cava





▶ **44** Right renal artery and left renal vein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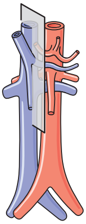
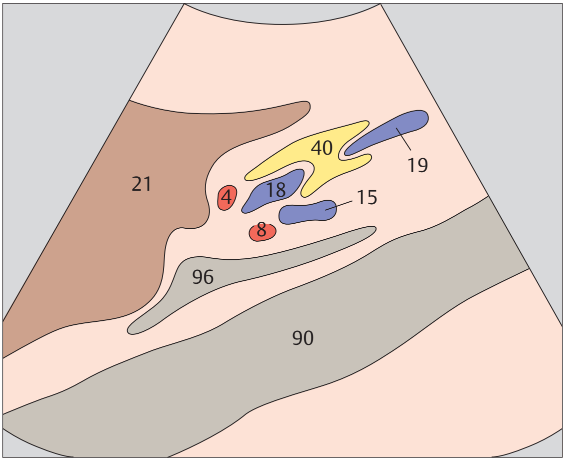


The right renal artery passes behind the vena cava, impressing its posterior surface.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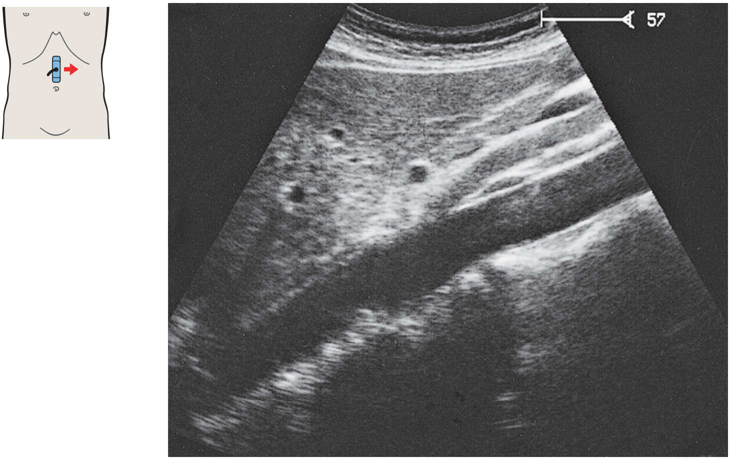
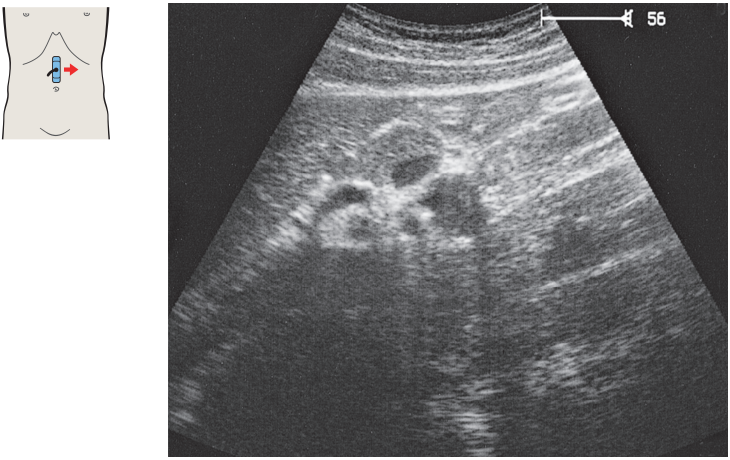
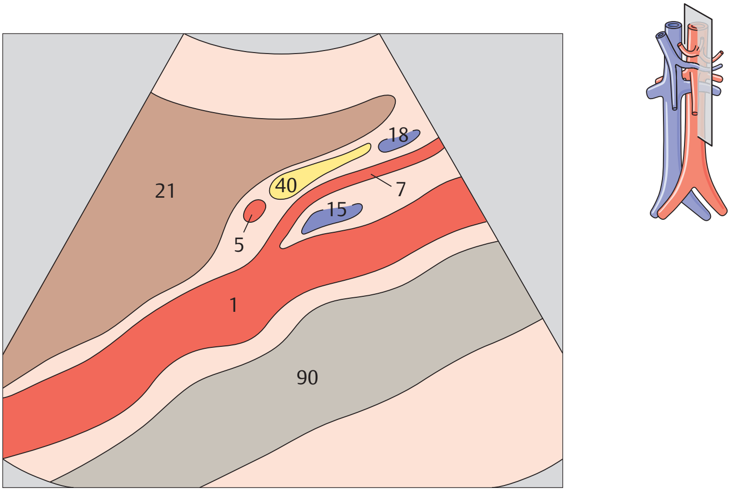
The scan plane cuts the left renal vein and right renal artery between the aorta and vena cava.



▶ **45** Aorta and left renal vein



▶ **46** Left renal vessels, splenic artery and vein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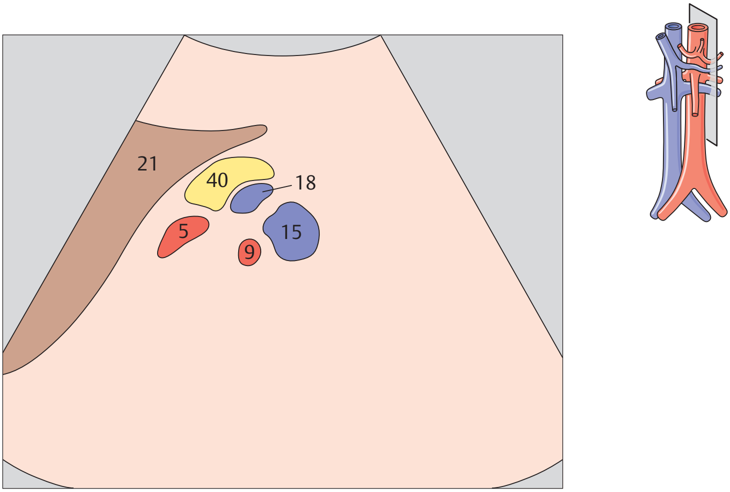
The left renal vein runs between the aorta and superior mesenteric artery. ◀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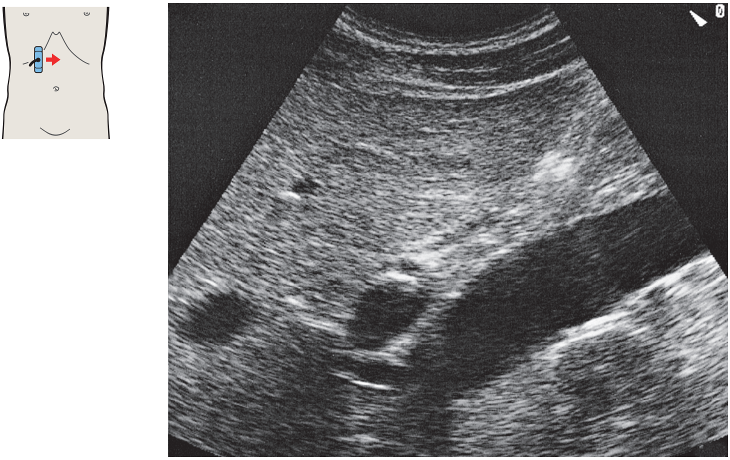
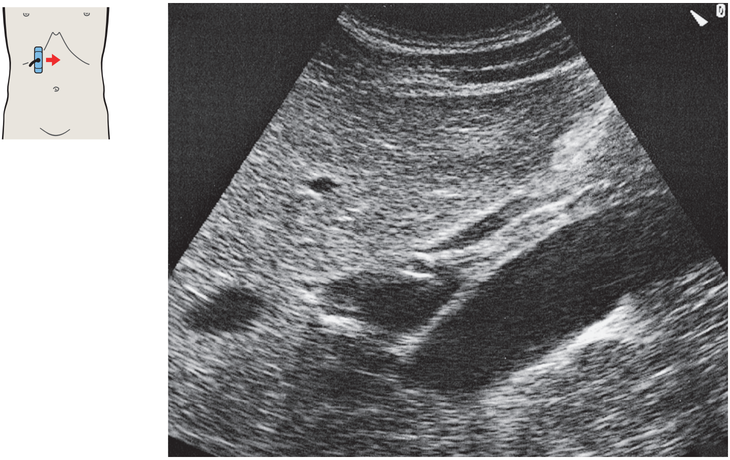
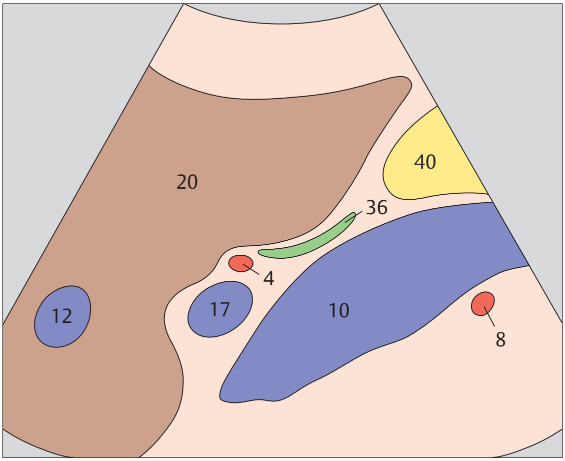
The left renal vessels are often difficult to scan because of overlying air. ◀

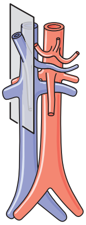


▶ **47** Portal vein, vena cava, right renal artery

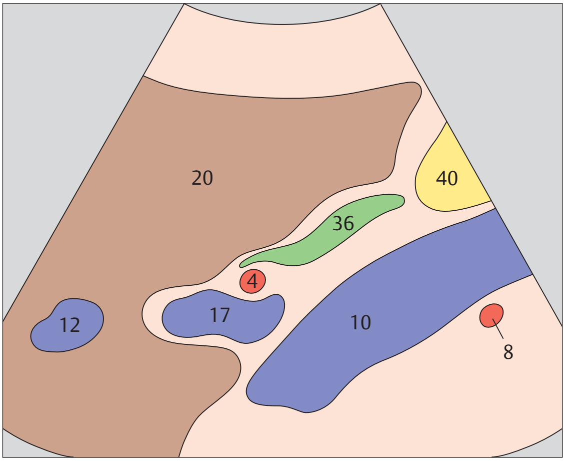


▶ **48** Portal vein, vena cava, right renal artery

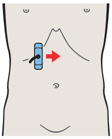


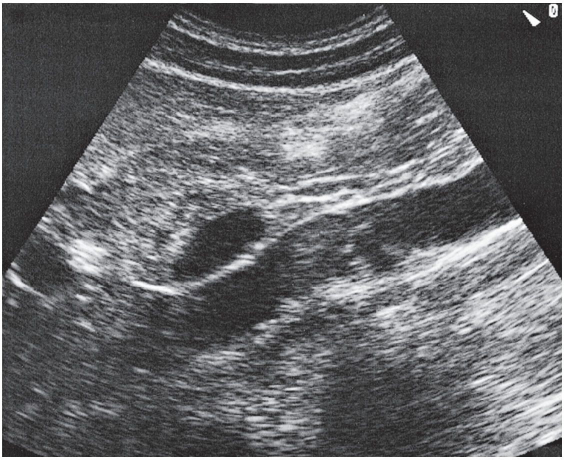


The triad of the portal vein, vena cava, and right renal artery provides a typical landmark in the upper abdominal longitudinal scan. ◀

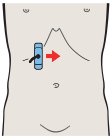


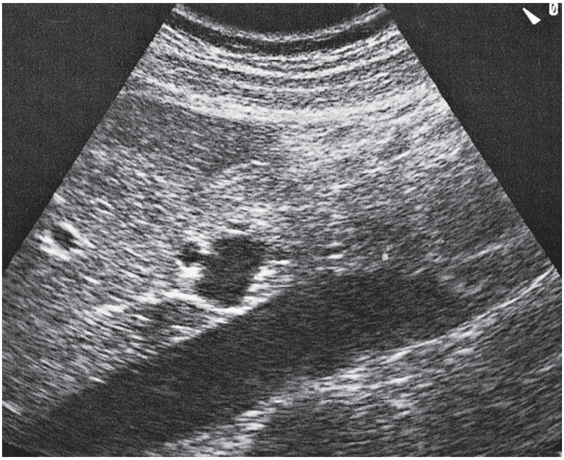
When the triad of the portal vein, vena cava, and right renal artery is identified, the scan will usually include a longitudinal section of the bile duct. ◀



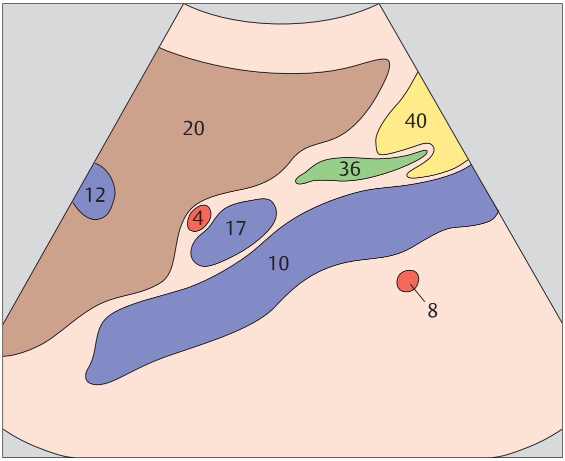


▶ **49** Portal vein, vena cava, and bile duct





▶ **50** Portal vein and hepatic artery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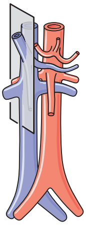
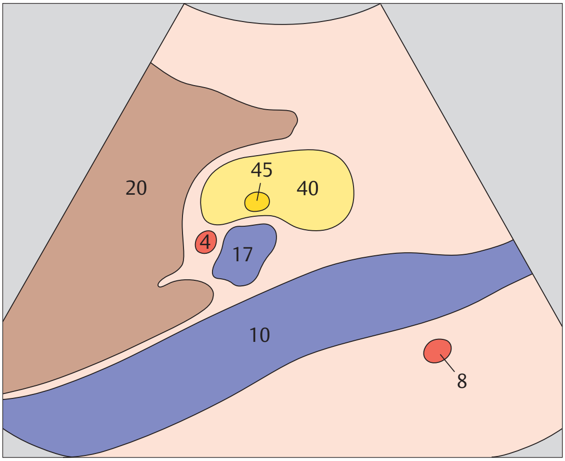


The bile duct enters the head of the pancreas anterior to the vena cava.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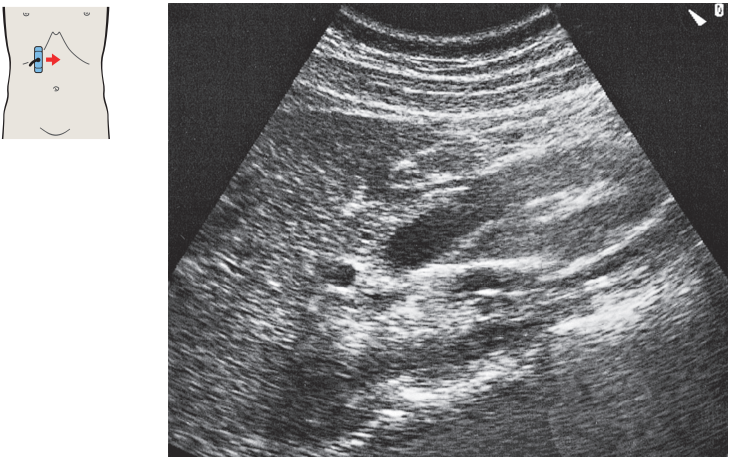
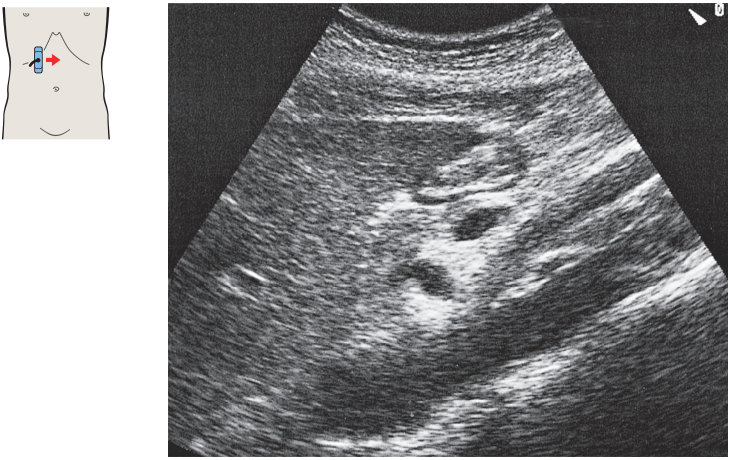
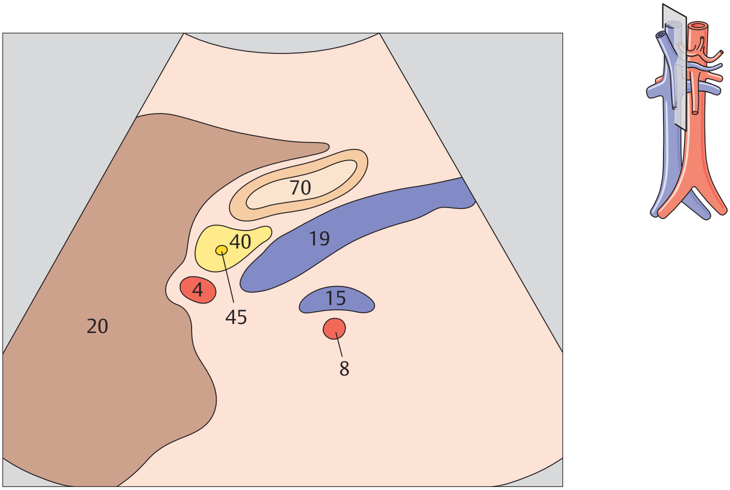
The portal vein and hepatic artery run side-by-side posterior to the head of the pancreas.



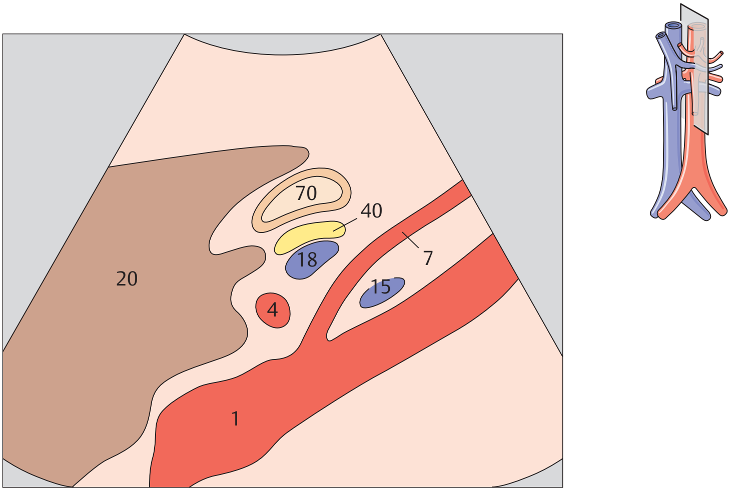
▶ **51** Hepatic artery, superior mesenteric vein



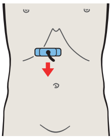
▶ **52** Hepatic artery, superior mesenteric artery, and splenic vein

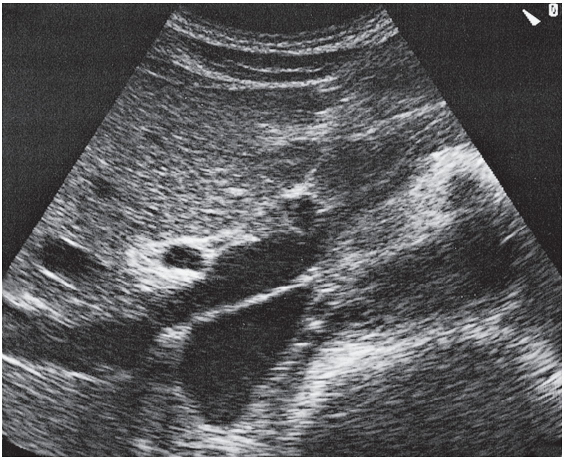


When the mesenteric vein is viewed in longitudinal section, typically the scan will also display the hepatic artery cranially and the right renal artery and left renal vein posteriorly.

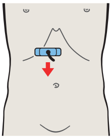


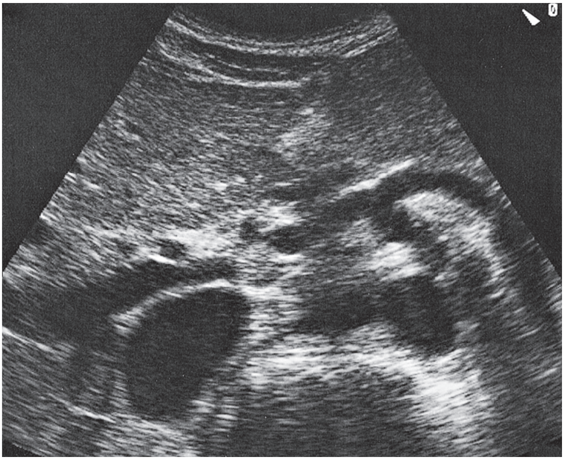
When the superior mesenteric artery is viewed in longitudinal section, typically the scan will also show the hepatic artery, splenic vein, and left renal vein.



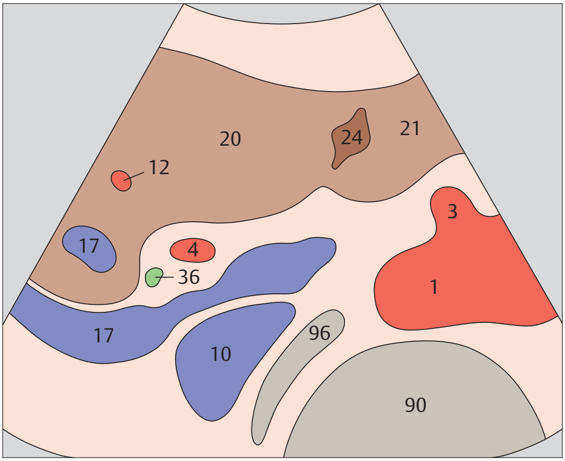


▶ **53** Hepatic artery, portal vein, vena cava





▶ **54** Hepatic artery, bile duct, portal vein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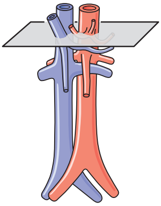
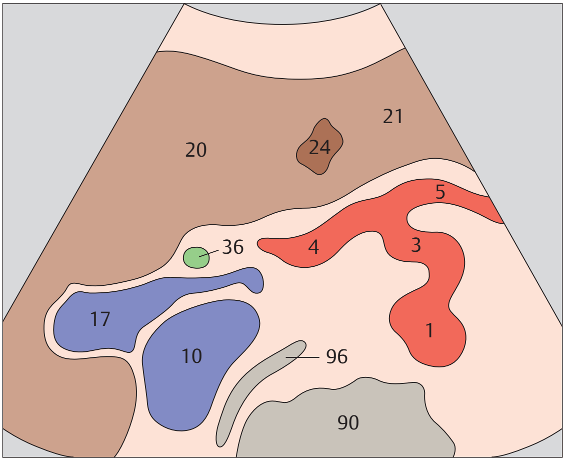


The portal vein runs between the vena cava and hepatic artery.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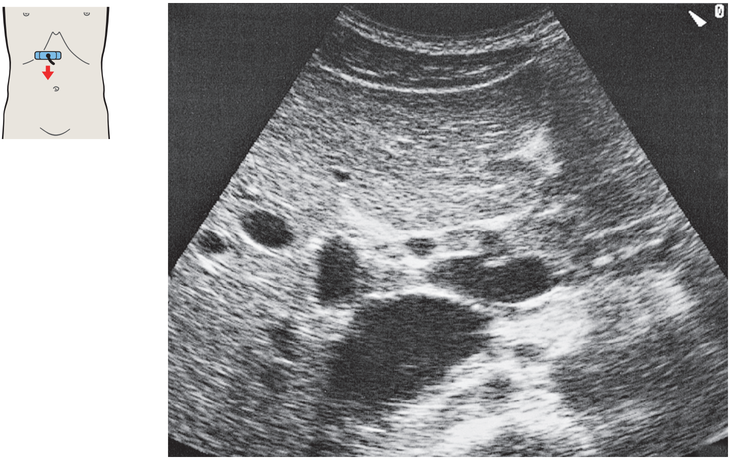
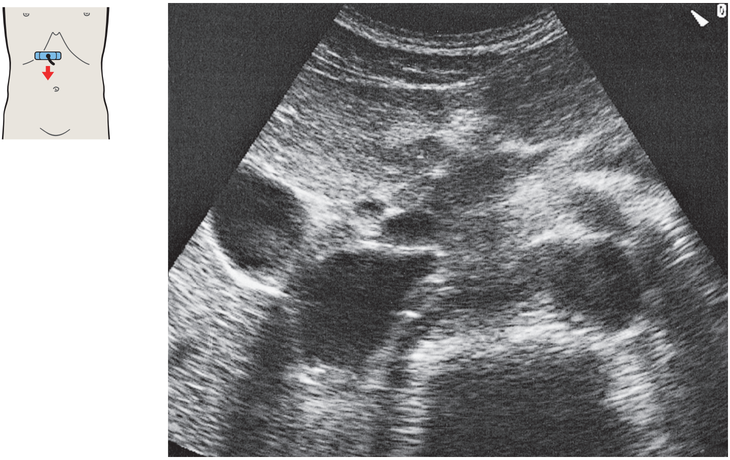
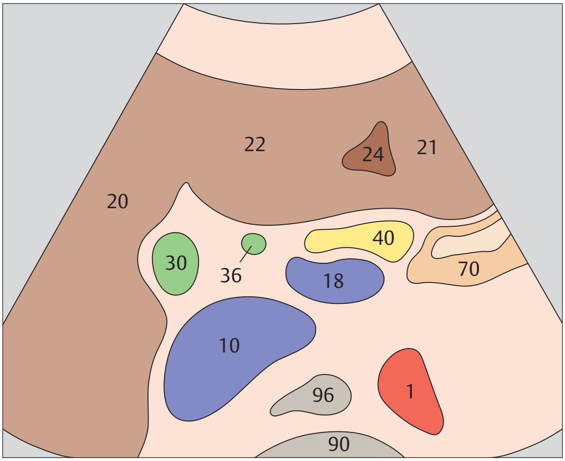
The hepatic artery runs cephalad into the porta hepatis.



▶ **55** Bile duct, gallbladder, vena cava



▶ **56** Bile duct, gallbladder, superior mesenteric vein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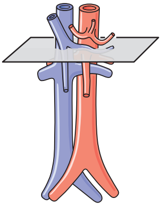
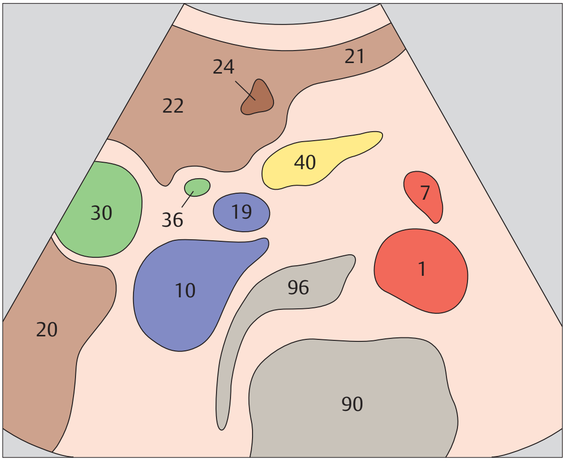


The bile duct is identified medial to the gallbladder and anterior to the vena cava.


24
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36
19
1
10
96
20
90

The bile duct runs parallel to the superior mesenteric vein for a short distance, then turns laterally to the right toward the papilla.

2 Liver

Liver in Longitudinal Sections

57 Left lobe of liver, lateral segment, subsegments II and III
58 Left lobe of liver, ligamentum teres, boundary between lateral and medial segments
59 Left lobe of liver, ligamentum teres, boundary between lateral and medial segments
60 Left lobe of liver, ligamentum teres, boundary between lateral and medial segments, caudate lobe
61 Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe
62 Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe
63 Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe
64 Medial segment, subsegment IV, quadrate lobe
65 Gallbladder, portal vein, vena cava, boundary between medial and anterior segments
66 Middle hepatic vein, boundary between medial and anterior segments
67 Anterior segment, subsegments VIII and V
68 Right hepatic vein, boundary between anterior and posterior segments
69 Posterior segment, subsegments VII and VI
70 Posterior segment, lateral portions of liver, kidney

Left Portions of the Liver in Transverse Sections

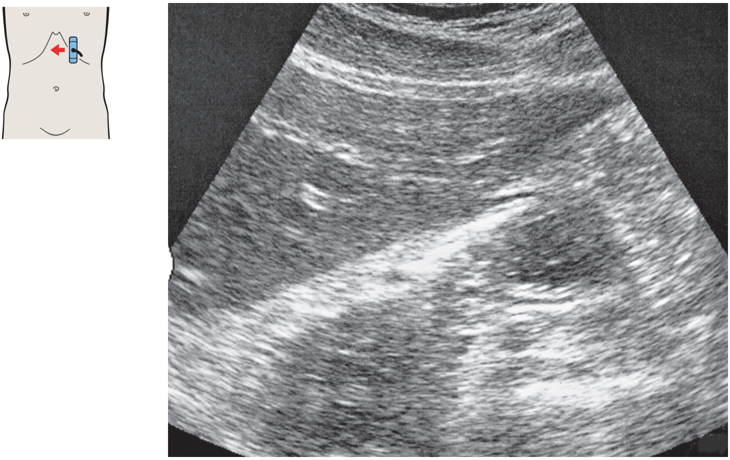
71 Left lobe of liver, lateral segment, heart
72 Left lobe of liver, lateral segment, heart
73 Left lobe of liver, lateral segment, hepatic veins
74 Left lobe of liver, lateral segment, caudate lobe
75 Left lobe of liver, lateral segment, caudate lobe
76 Left lobe of liver, lateral segment, left portal vein branch
77 Left lobe of liver, lateral segment, ligamentum teres
78 Left lobe of liver, subsegment III, ligamentum teres

Central Portions of the Liver in Transverse Sections

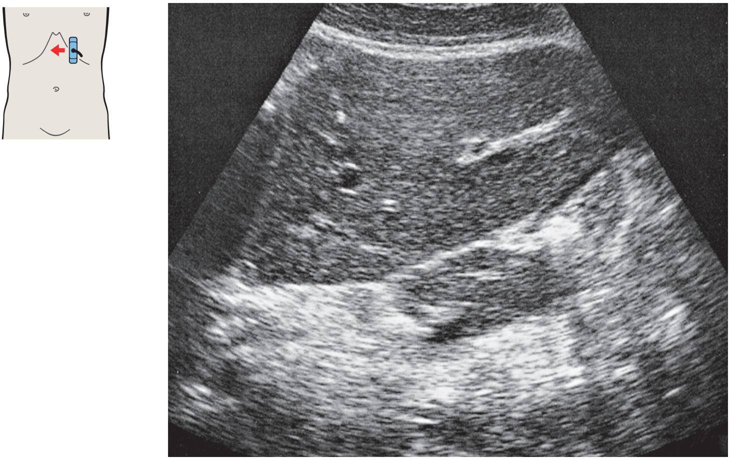
79 Medial and anterior hepatic segments, opening of hepatic veins
80 Medial and anterior hepatic segments, opening of hepatic veins
81 Medial and anterior hepatic segments, hepatic veins, caudate lobe
82 Medial and anterior hepatic segments, hepatic veins, caudate lobe
83 Medial and anterior hepatic segments, caudate lobe
84 Medial and anterior hepatic segments, left portal vein branch, caudate lobe
85 Medial and anterior hepatic segments, left portal vein branch, caudate lobe
86 Medial and anterior hepatic segments, left portal vein branch, caudate lobe
87 Medial and anterior hepatic segments, bifurcation of portal vein
88 Medial and anterior hepatic segments, bifurcation of portal vein
89 Medial and anterior hepatic segments, right portal vein branch
90 Medial and anterior hepatic segments, right and left portal vein branches
91 Medial and anterior hepatic segments, right and left portal vein branches
92 Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, portal vein
93 Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, portal vein
94 Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, gallbladder
95 Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, gallbladder
96 Inferior border of liver, kidney, gallbladder, ligamentum teres

Right Portions of the Liver in Transverse Sections

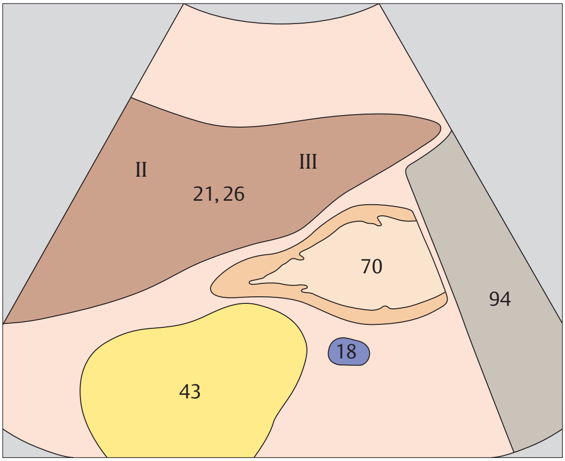
97 Posterior segment, cranial subsegment
98 Posterior segment, portal vein
99 Posterior segment, caudal subsegment, kidney
100 Posterior segment, inferior border



▶ **57** Left lobe of liver, lateral segment, subsegments II and III



▶ **58** Left lobe of liver, ligamentum teres, boundary between lateral and medial segments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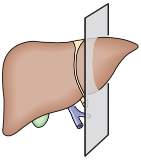
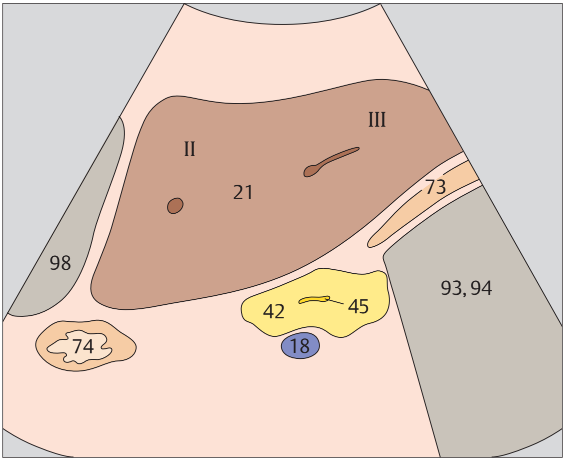


The liver is divided into a left and a right lobe on anatomical criteria. The left lobe corresponds to the lateral segment; the right lobe consists of the medial, anterior, and posterior segments.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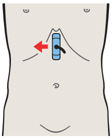
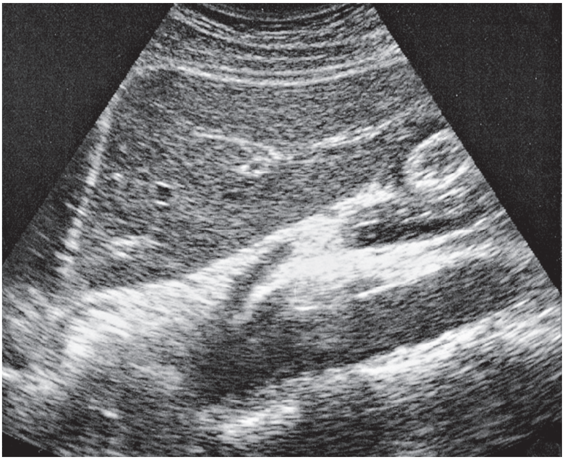
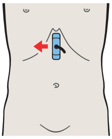
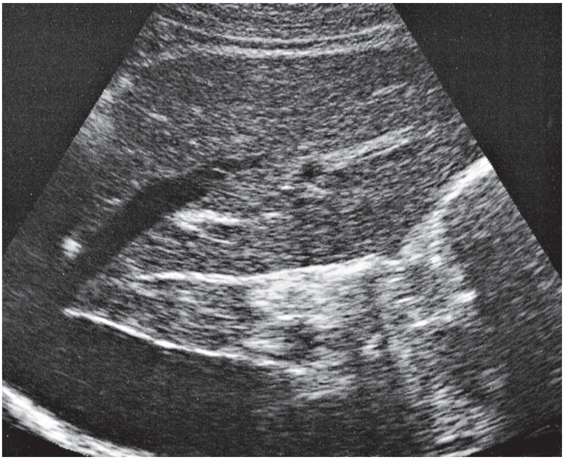
On functional criteria, the lateral and medial segments belong to the left lobe of the liver while the anterior and posterior segments belong to the right lobe.



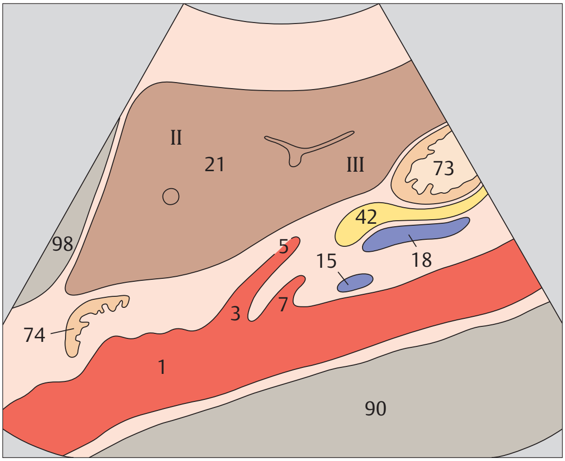


▶ **59** Left lobe of liver, ligamentum teres, boundary between lateral and medial segments





▶ **60** Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe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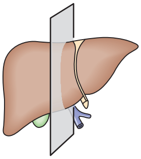
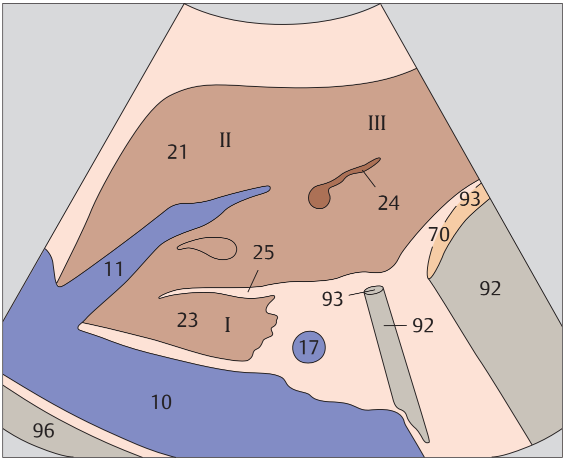
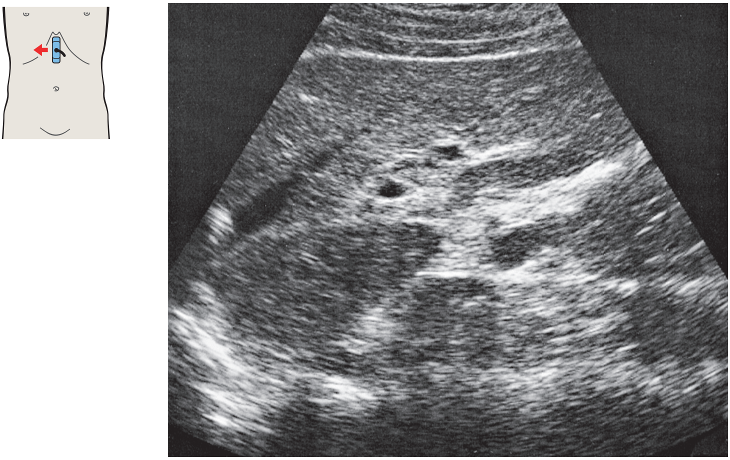
74
1
90



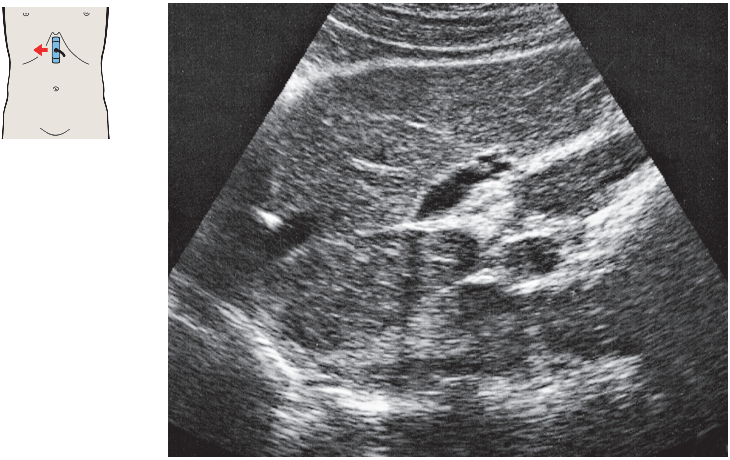
The lateral segment is composed of subsegment II cranially and subsegment III caudally.


III
21
II
24
93
70
25
11
92
93
92
23
I
17
10
96

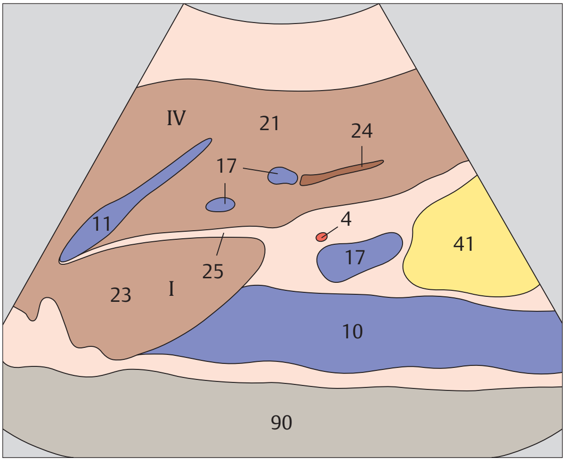
The boundary between the lateral and medial segments, i.e., between the anatomical left and right lobes of the liver, is the left hepatic vein.

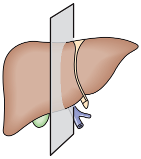


► **61** Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe

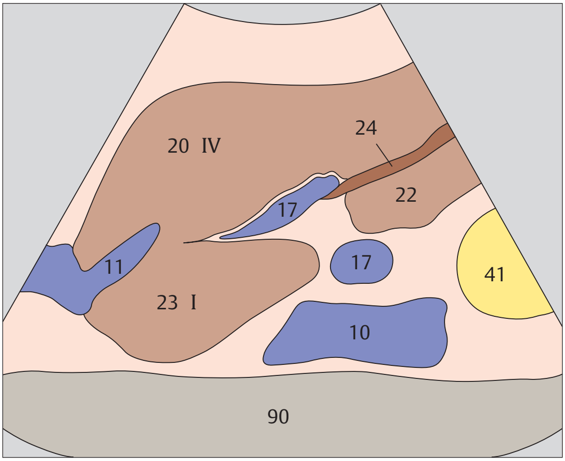


► **62** Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe

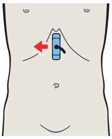

IV
21
24
17
11
4
17
41
25
23
I
10
90

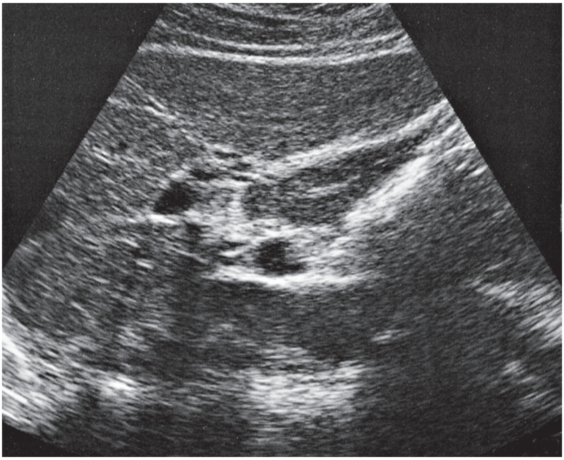


The caudate lobe corresponds to subsegment I of the medial segment and is located lateral and anterior to the vena cava. Most of the medial segment consists of subsegment IV.

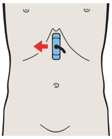

24
20 IV
22
17
11
17
41
23 I
10
90

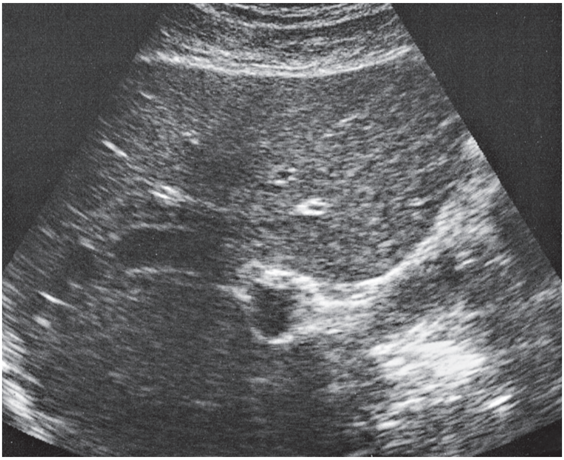
The boundary between the lateral and medial segments, i.e., between the anatomical left and right lobes of the liver, is the ligamentum teres.



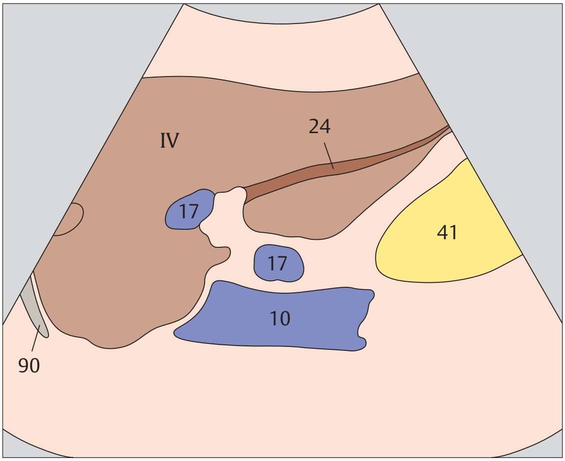


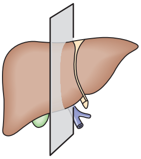
▶ **63** Left hepatic vein, ligamentum teres, boundary between lateral and medial segments, caudate lobe



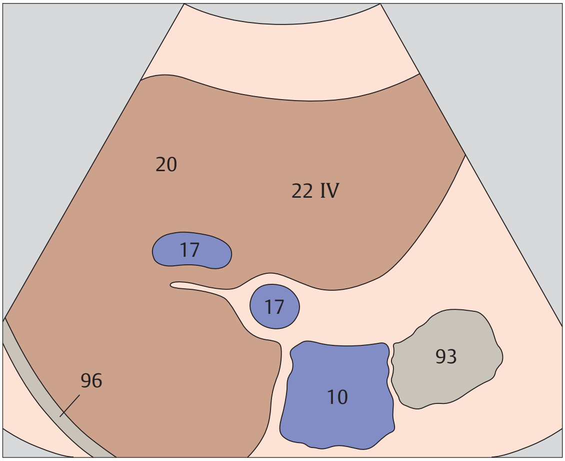


▶ **64** Medial segment, subsegment IV, quadrate lobe

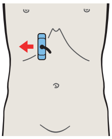


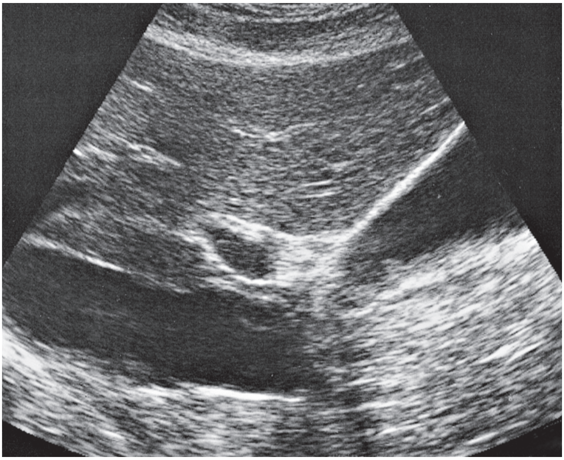


Ligamentum teres (the obliterated umbilical vein) extends from the left portal vein branch to the anterior inferior border of the liver.

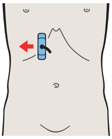


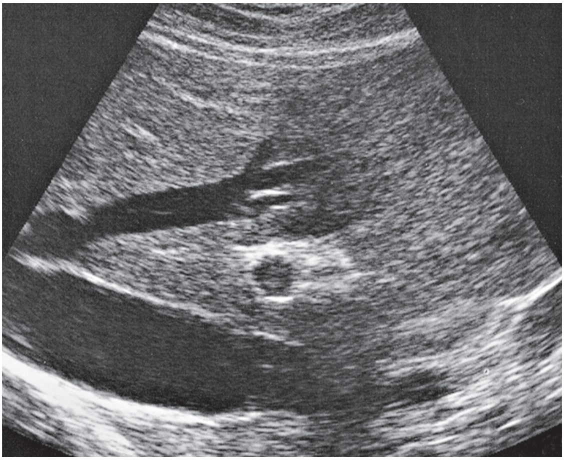
The caudal part of the medial segment, the quadrate lobe, is situated between ligamentum teres and the gallbladder. The quadrate lobe is part of subsegment IV.



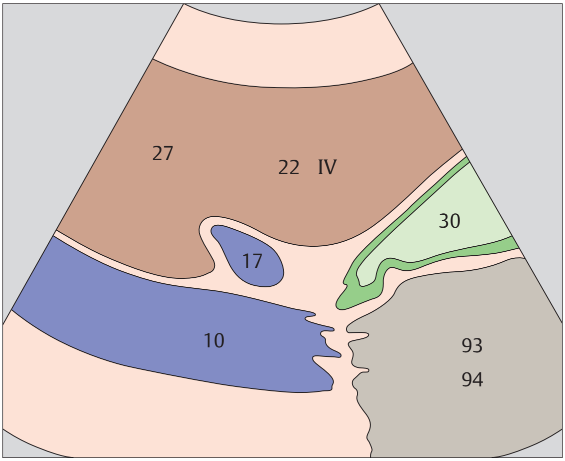


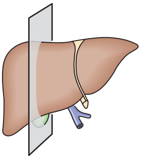
▶ **65** Gallbladder, portal vein, vena cava, boundary between medial and anterior segments



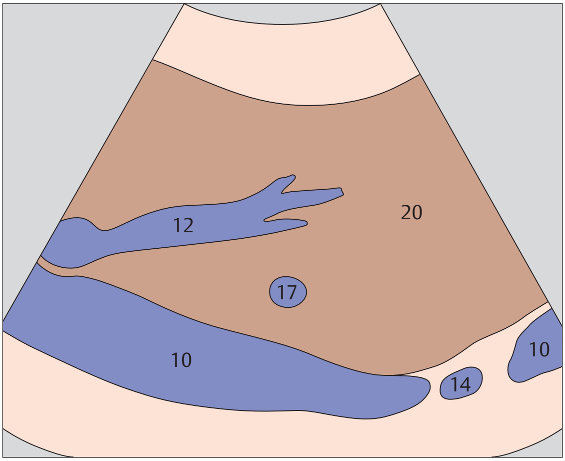


▶ **66** Middle hepatic vein, boundary between medial and anterior segmentst

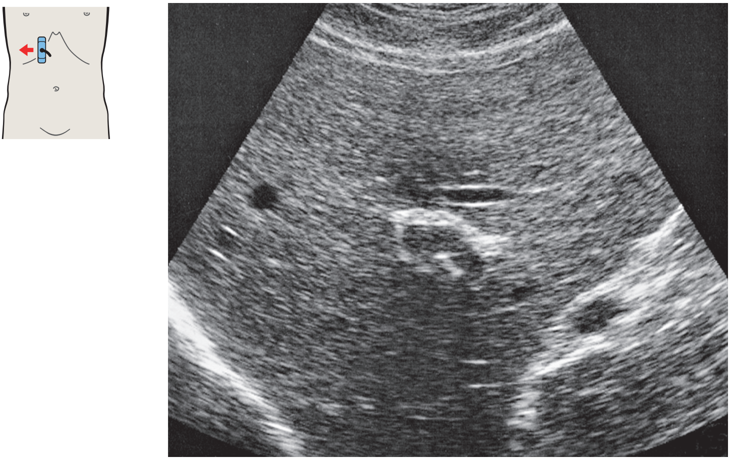




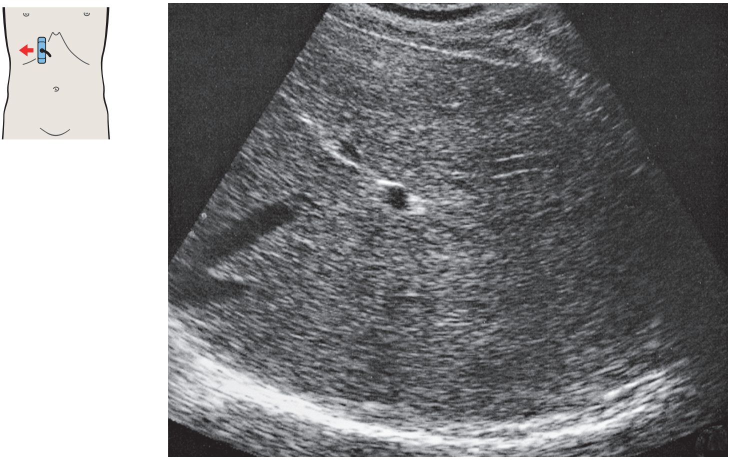
The plane of the gallbladder and vena cava forms the boundary plane between the medial and anterior segments of the liver.



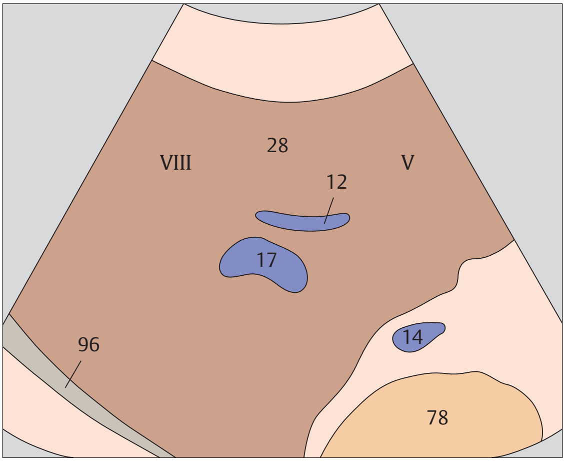
The middle hepatic vein marks the boundary between the medial and anterior segments in the cranial part of the liver.

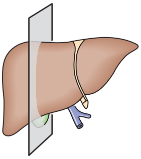


▶ **67** Anterior segment, subsegments VIII and V

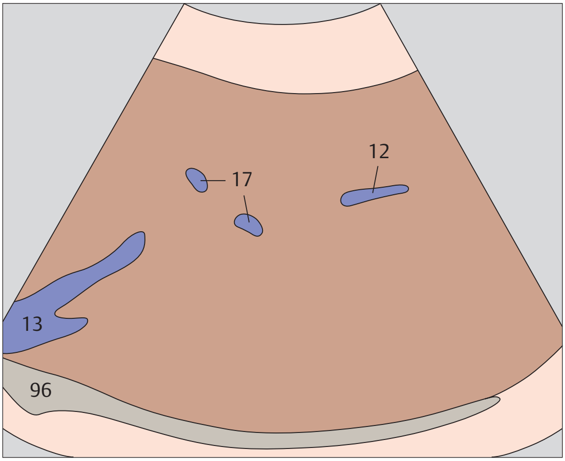


▶ **68** Right hepatic vein, boundary between anterior and posterior segments

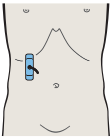

28
VIII
V
12
17
96
14
78

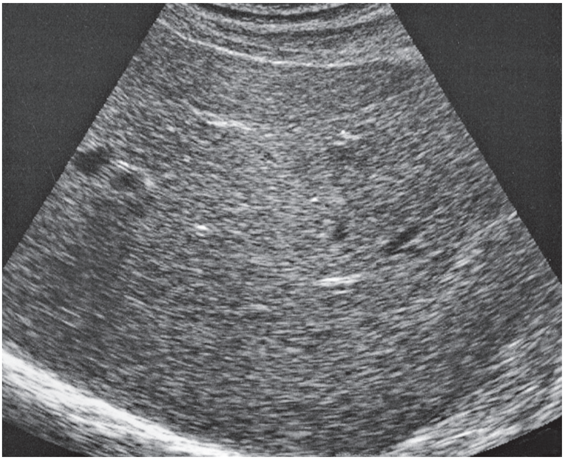


The anterior segment consists of subsegment VIII cranially and subsegment V caudally. ◄

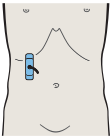


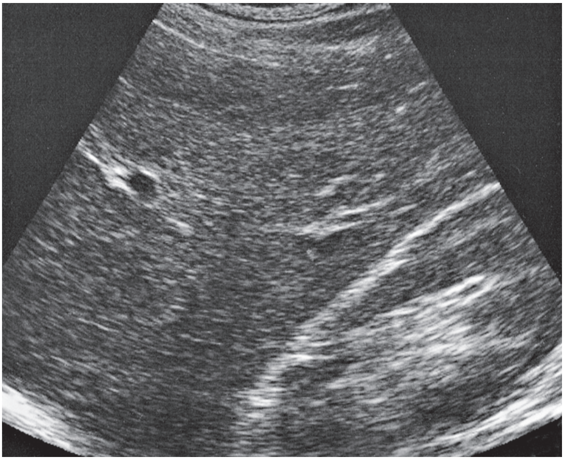
The right hepatic vein and the division of the right portal vein branch mark the boundary plane between the anterior and posterior segments. ◄



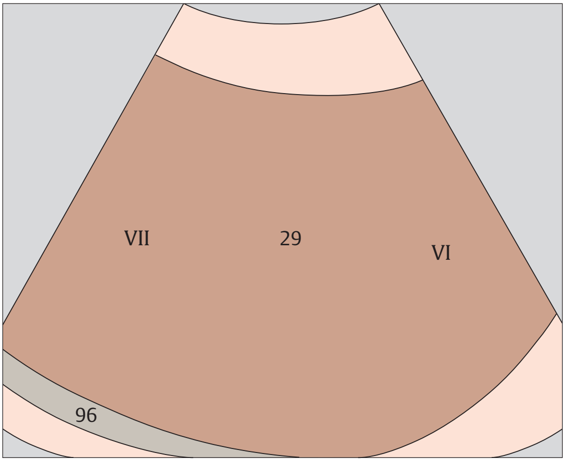


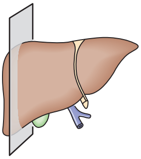
▶ **69** Posterior segment, subsegments VII and VI



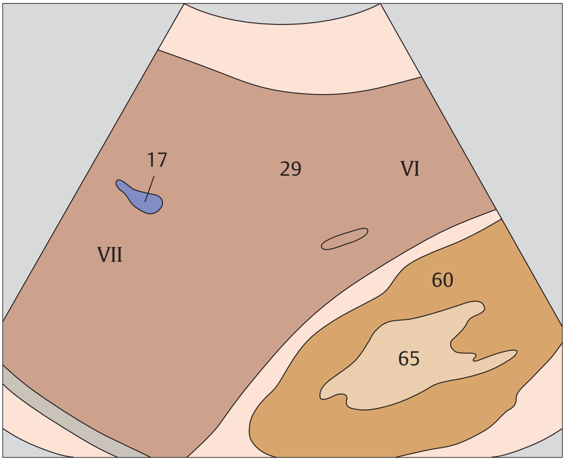


▶ **70** Posterior segment, lateral portions of liver, kidney

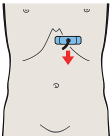


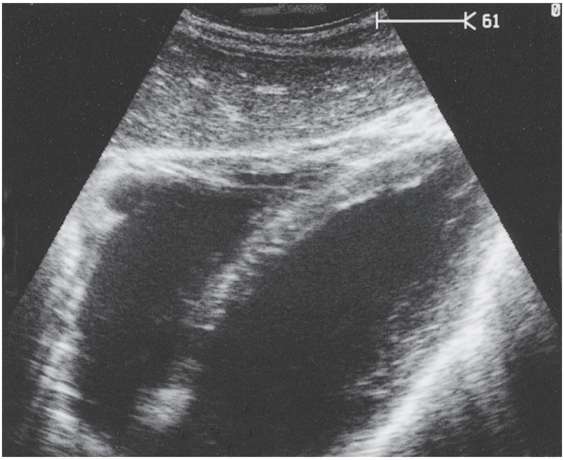


The posterior segment consists of subsegment VII cranially and subsegment VI caudally.

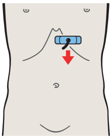

17
29
VI
VII
60
65

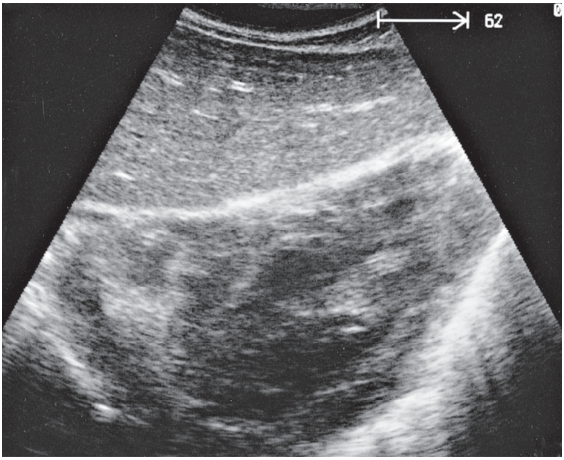
The right lobe of the liver is highly variable in its caudal extent.



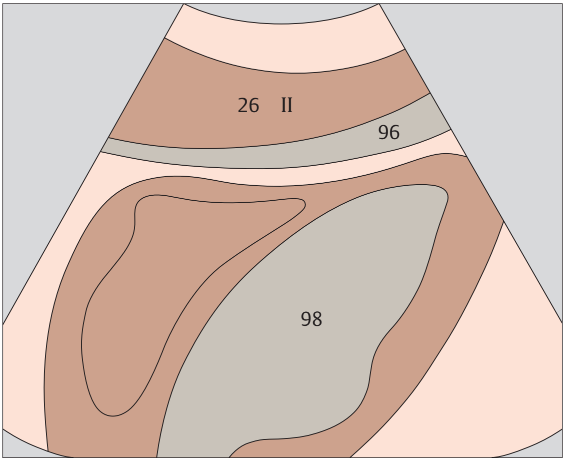


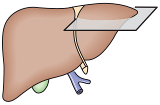
► **71** Left lobe of liver, lateral segment, heart



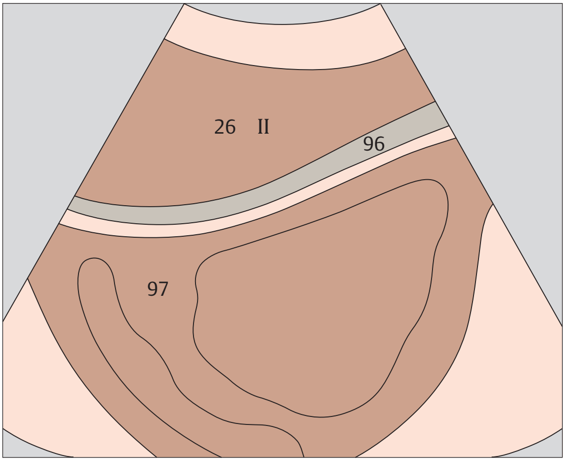


► **72** Left lobe of liver, lateral segment, heart

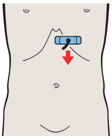


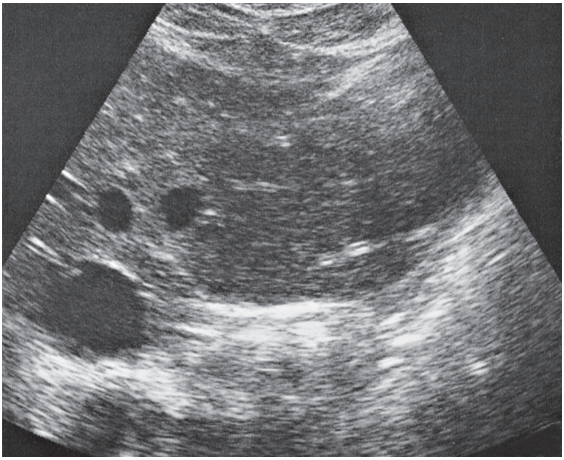


The left lobe of the liver is in close proximity to the heart, separated from it only by the diaphragm.

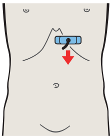


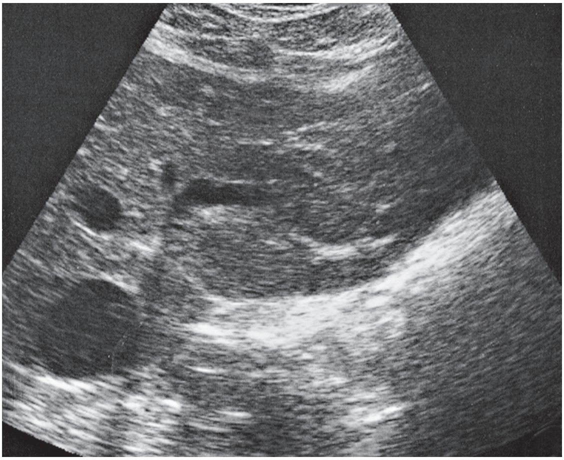
The anatomical left lobe of the liver corresponds to the lateral hepatic segment.



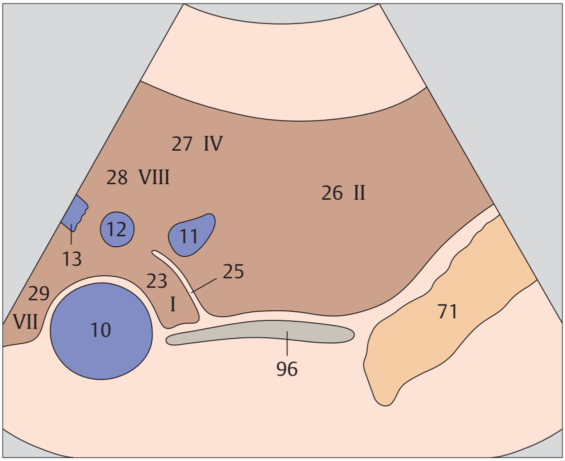


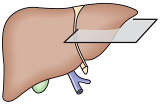
▶ **73** Left lobe of liver, lateral segment, hepatic veins



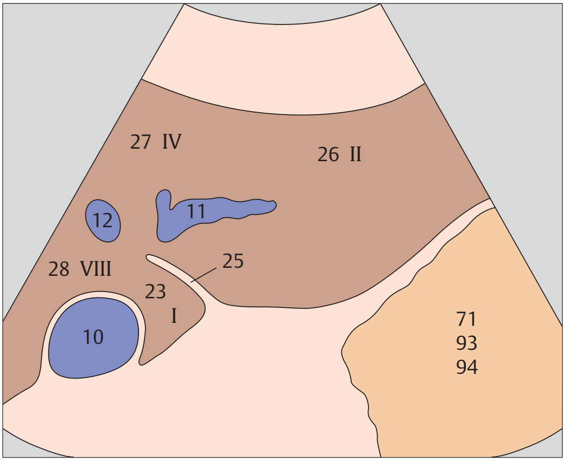


▶ **74** Left lobe of liver, lateral segment, caudate lobe


27 IV
28 VIII
26 II
12
11
13
25
23
I
29
VII
10
71
96



The left hepatic vein marks the boundary between the lateral and medial hepatic segments. ◀


27 IV
26 II
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28 VIII
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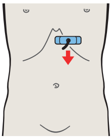
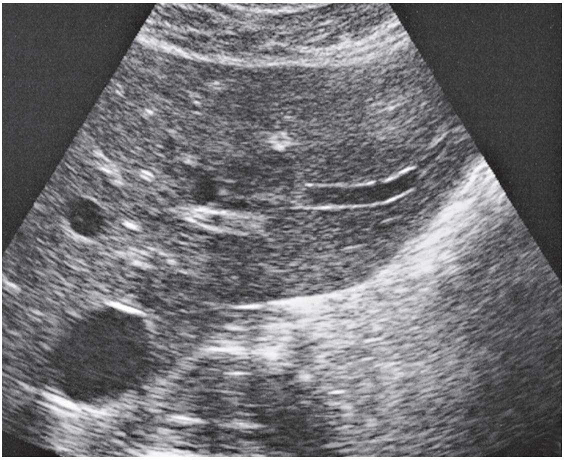
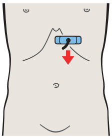
23
I
10
71
93
94

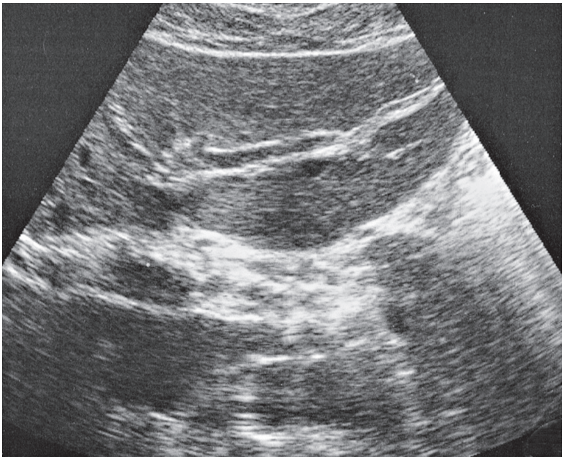
The cranial part of the lateral hepatic segment is designated as subsegment II. ◀



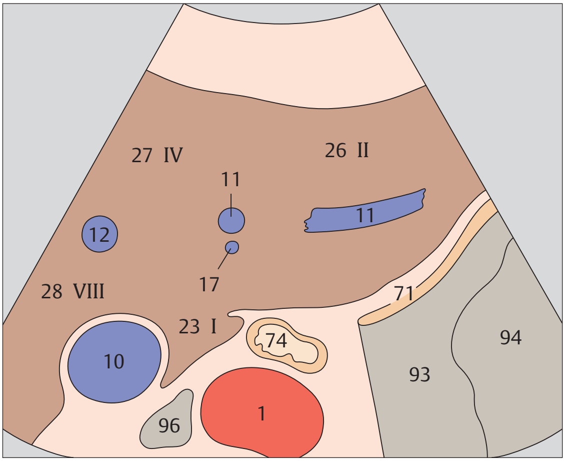


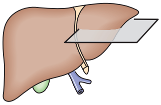
▶ **75** Left lobe of liver, lateral segment, caudate lobe



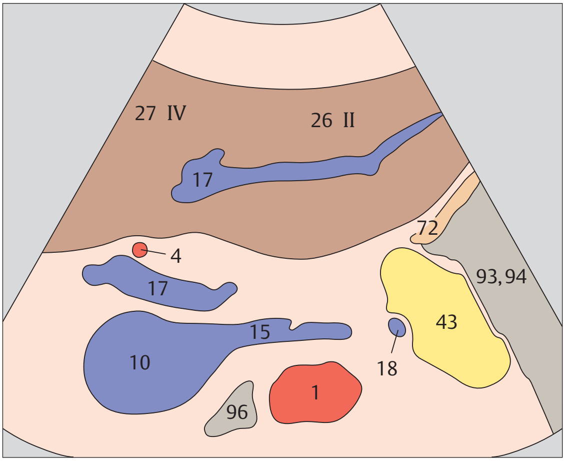


▶ **76** Left lobe of liver, lateral segment, left portal vein branch

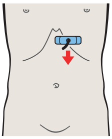

27 IV
26 II
11
11
12
17
28 VIII
71
23 I
74
10
94
93
96
1

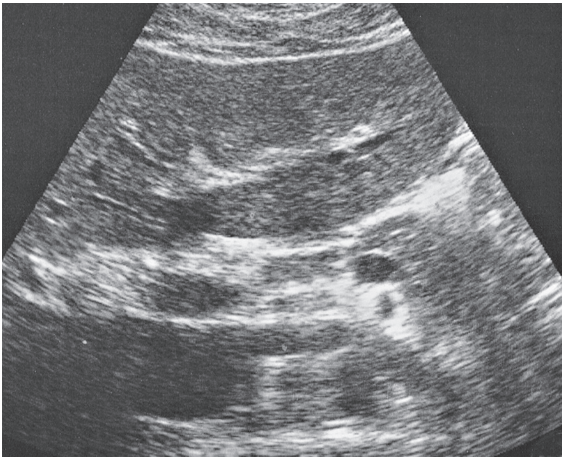


The caudate lobe is considered a separate entity, designated as subsegment I.

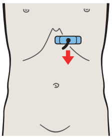

27 IV
26 II
17
72
4
17
93, 94
43
15
10
18
1
96

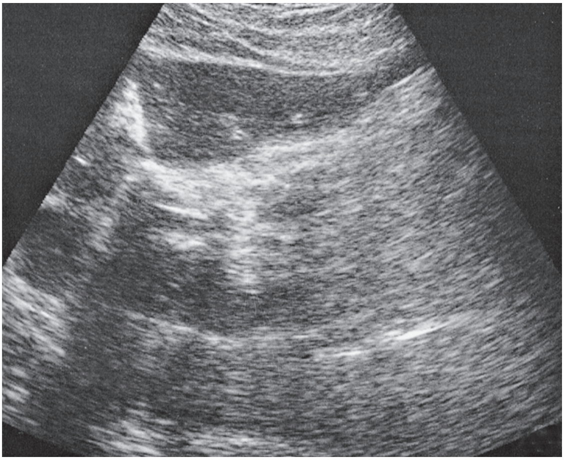
In scanning down the left lobe of the liver, the left branch of the portal vein marks the boundary between the cranial and caudal subsegments of the lobe.



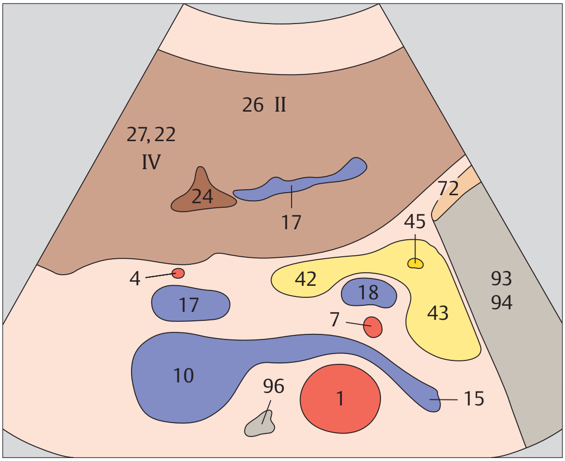


▶ **77** Left lobe of liver, lateral segment, ligamentum teres





▶ **78** Left lobe of liver, subsegment III, ligamentum teres


26 II
27, 22
IV
24
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72
45
4
42
18
17
93
94
7
43
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96
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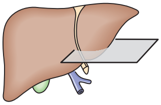
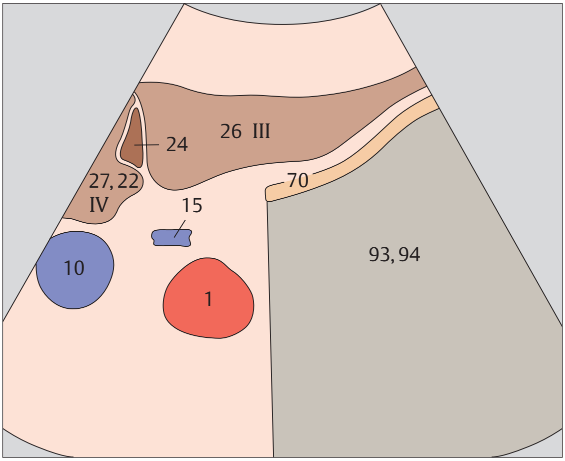
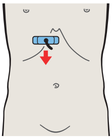
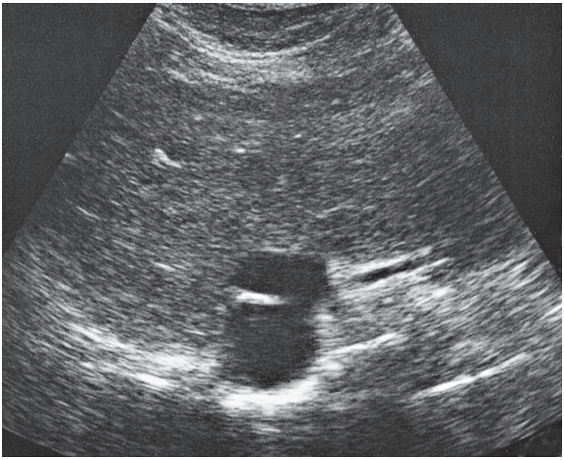


Ligamentum teres arises directly from the left portal vein branch and runs forward and downward.

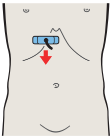

26 III
24
27, 22
IV
70
15
10
93, 94
1

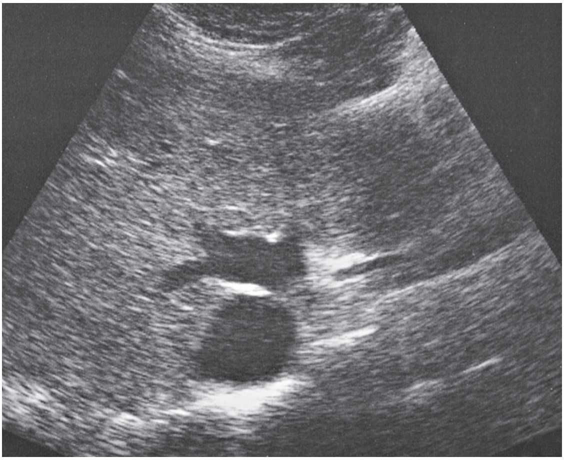
Ligamentum teres presents a triangular or polygonal shape in cross section. It marks the boundary between subsegment III and the quadrate lobe, which is designated as subsegment IVb.



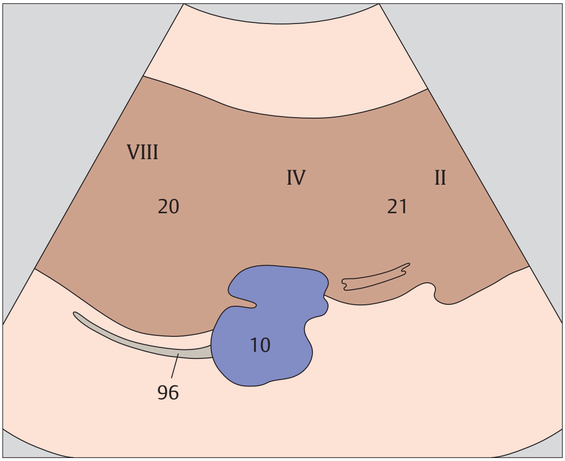


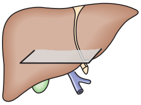
▶ **79** Medial and anterior hepatic segments, opening of hepatic veins



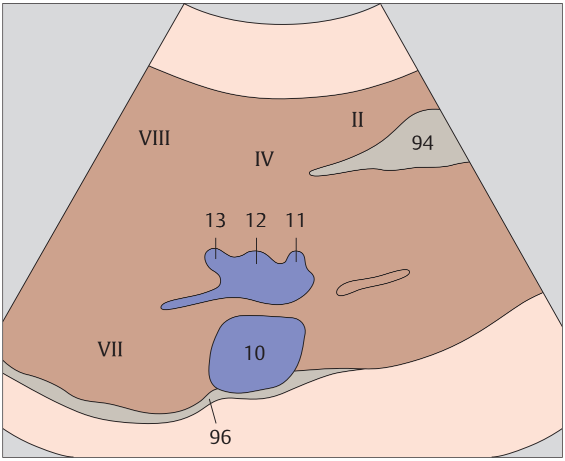


▶ **80** Medial and anterior hepatic segments, opening of hepatic veins

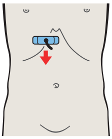

VIII
IV
II
20
21
10
96

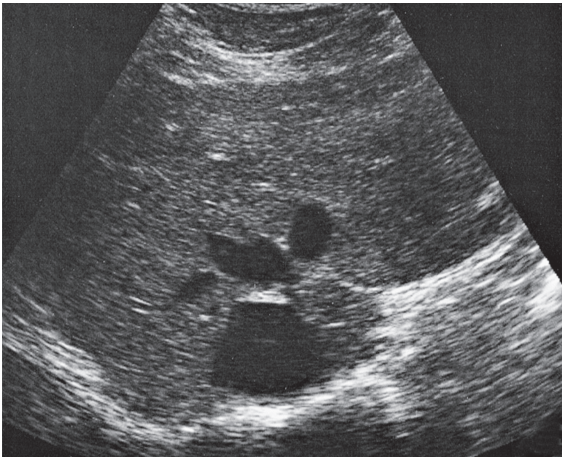


The hepatic veins converge and enter the vena cava just below the diaphragm.

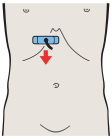

VIII
IV
II
94
13
12
11
VII
10
96

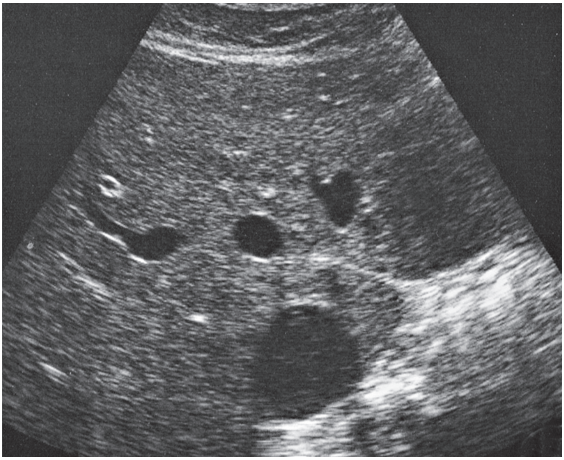
The opening of the hepatic veins at the vena cava forms a typical stellate pattern in transverse section.



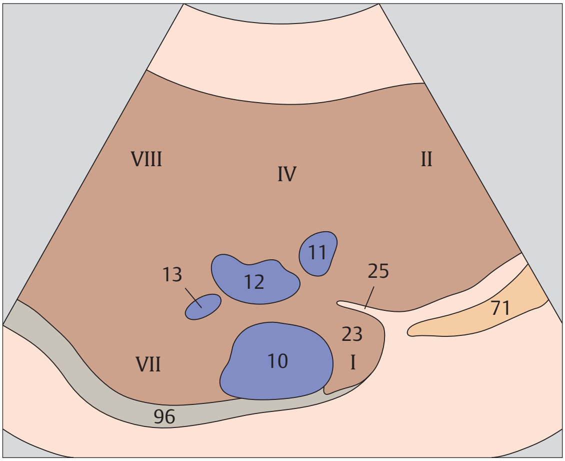


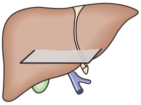
▶ **81** Medial and anterior hepatic segments, hepatic veins, caudate lobe





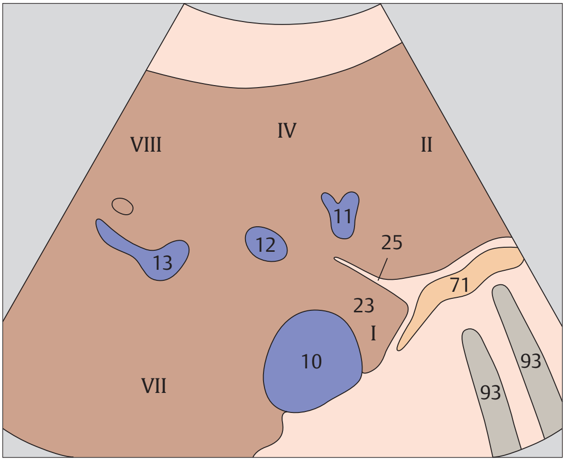
▶ **82** Medial and anterior hepatic segments, hepatic veins, caudate lobe


VIII
IV
II
11
13
12
25
71
23
VII
10
I
96



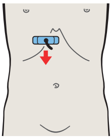
The upper pole of the caudate lobe extends to a point just below the opening of the hepatic veins into the vena cava.

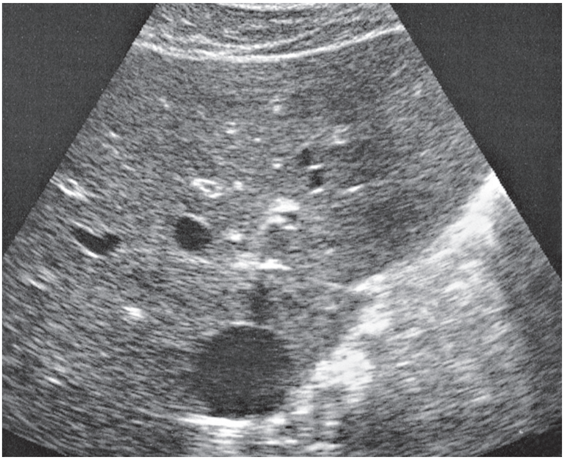
◀


IV
VIII
II
11
12
13
25
71
23
I
10
93
93
VII

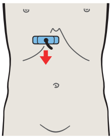
The three hepatic veins define the boundaries between the lateral, medial, anterior, and posterior segments of the liver.

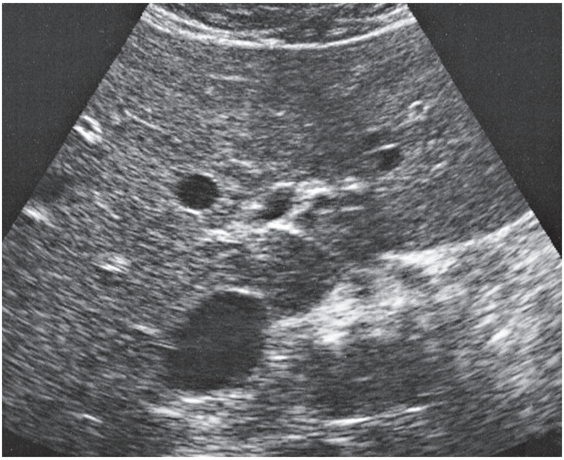
◀



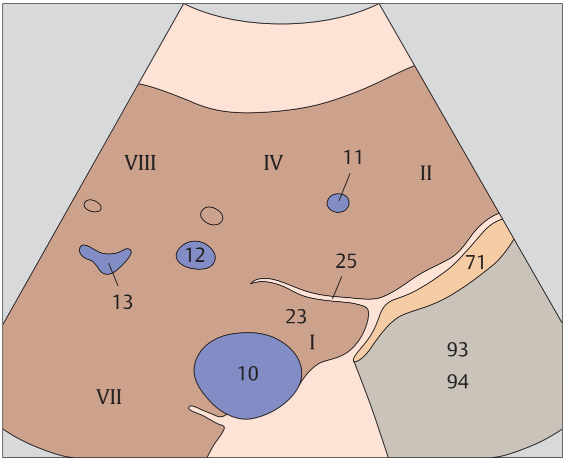


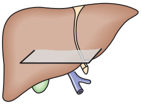
▶ **83** Medial and anterior hepatic segments, caudate lobe



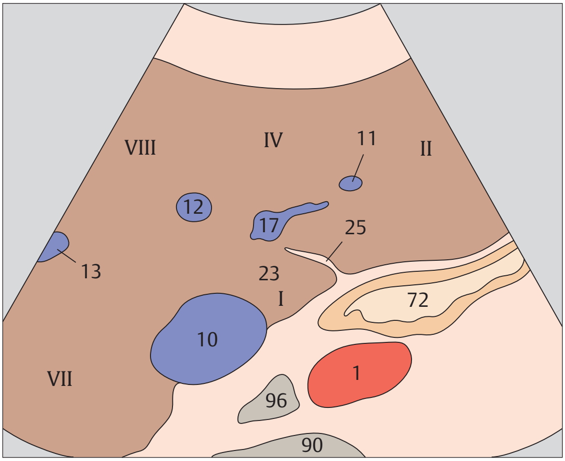


▶ **84** Medial and anterior hepatic segments, left portal vein branch, caudate lobe

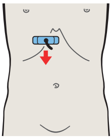

VIII
IV
11
II
12
13
25
71
23
I
93
94
10
VII

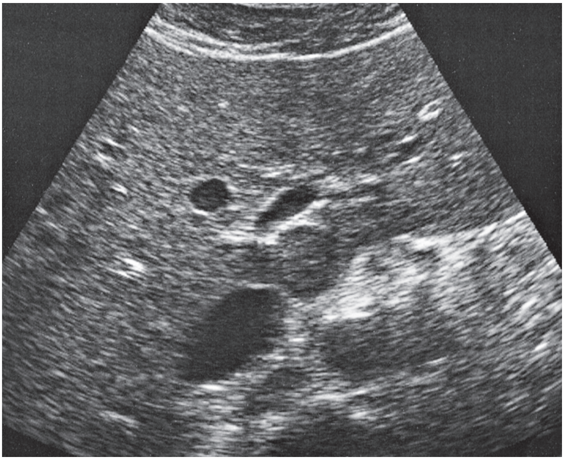


Ligamentum venosum separates the caudate lobe from subsegment II of the lateral hepatic segment. ◀

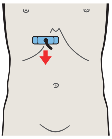

VIII
IV
11
II
12
17
25
13
23
I
72
10
1
VII
96
90

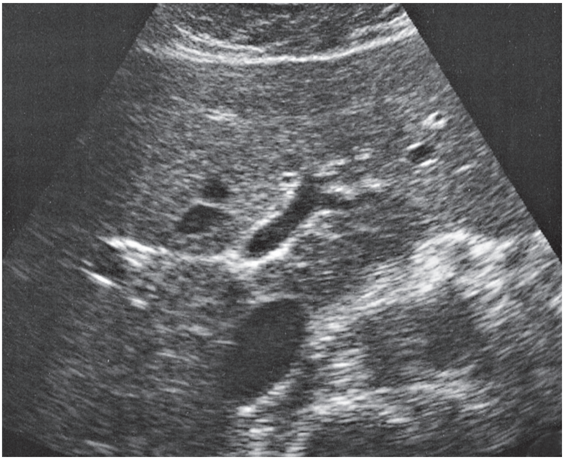
The caudate lobe of the liver is designated as subsegment I. ◀



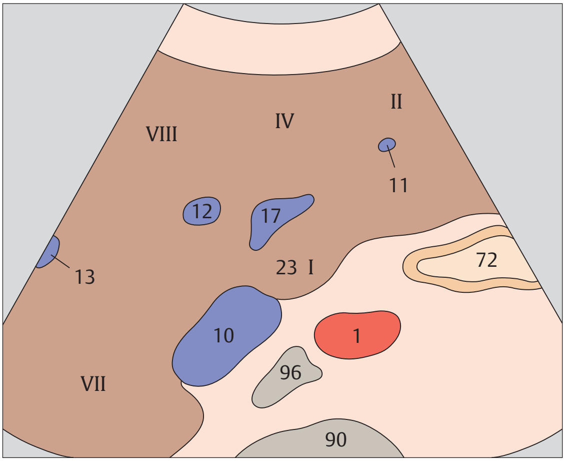


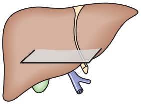
▶ **85** Medial and anterior hepatic segments, left portal vein branch, caudate lobe



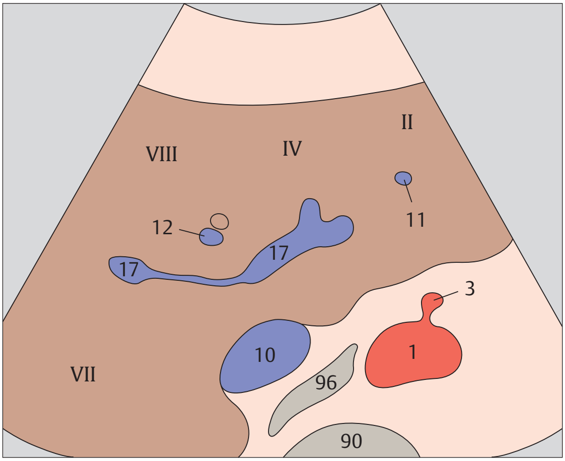


▶ **86** Medial and anterior hepatic segments, left portal vein branch, caudate lobe

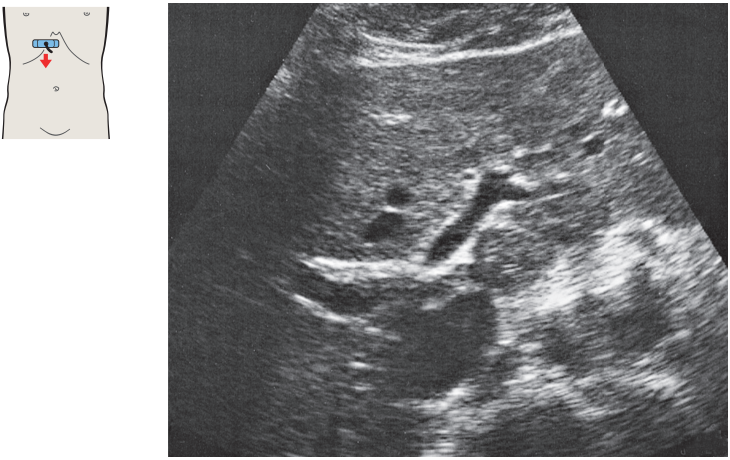

II
IV
VIII
11
12
17
13
23
I
72
10
1
96
VII
90



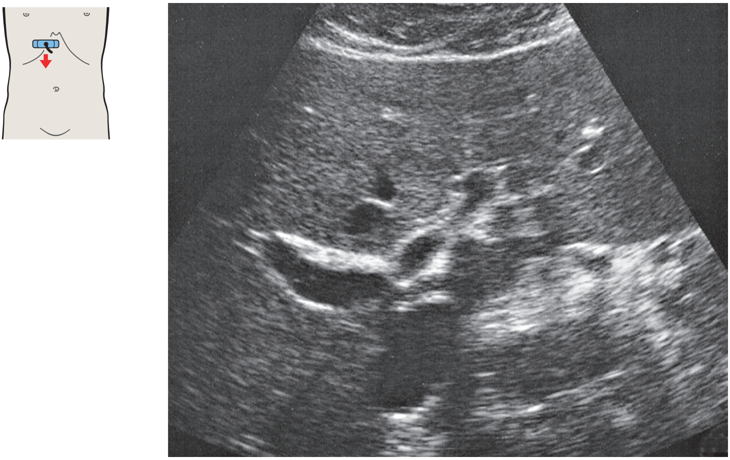
The caudate lobe is interposed between the vena cava and left portal vein branch.


II
VIII
IV
11
12
17
17
3
10
1
96
VII
90

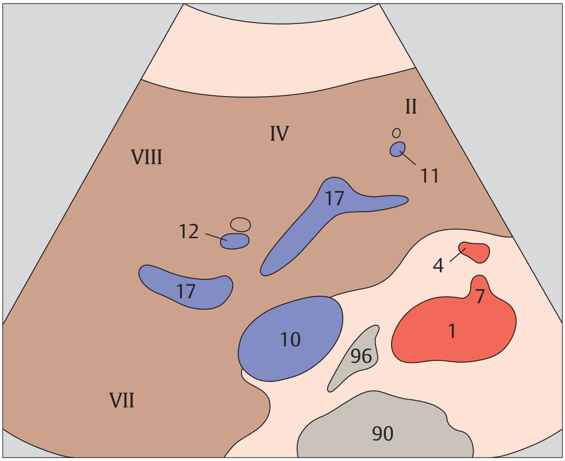
The upper subsegments of the lateral and medial hepatic segments are designated as subsegment II and subsegment IVa, respectively.

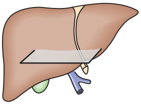


▶ **87** Medial and anterior hepatic segments, bifurcation of portal vein

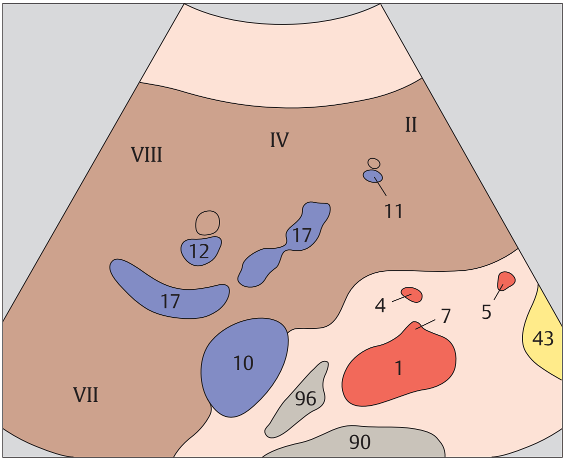


▶ **88** Medial and anterior hepatic segments, bifurcation of portal vein

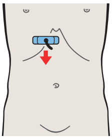

II
IV
VIII
11
17
12
4
17
7
1
10
96
VII
90

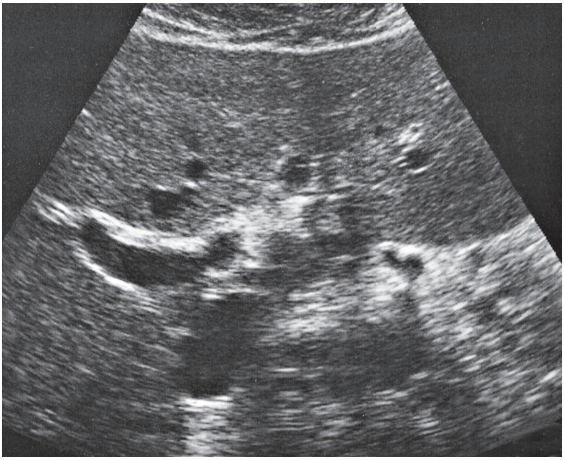


The upper subsegments of the anterior and posterior hepatic segments are designated as subsegments VIII and VII. ◀

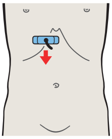

II
IV
VIII
11
17
12
17
4
7
5
43
10
1
96
VII
90

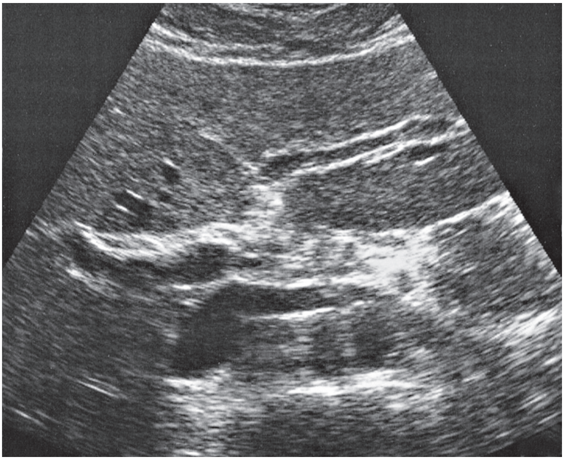
The bifurcation of the portal vein is located just anterior to the vena cava. ◀



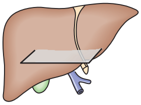


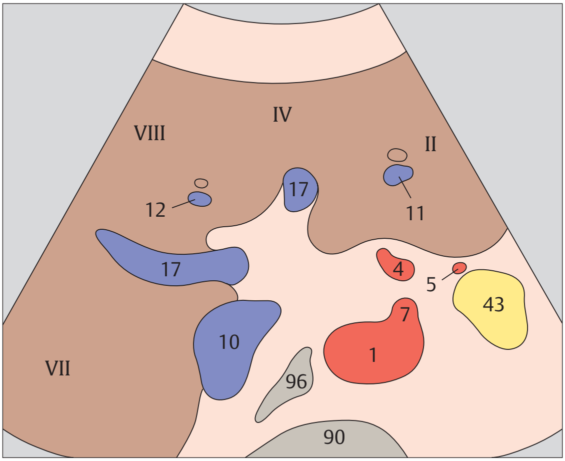
▶ **89** Medial and anterior hepatic segments, right portal vein branch





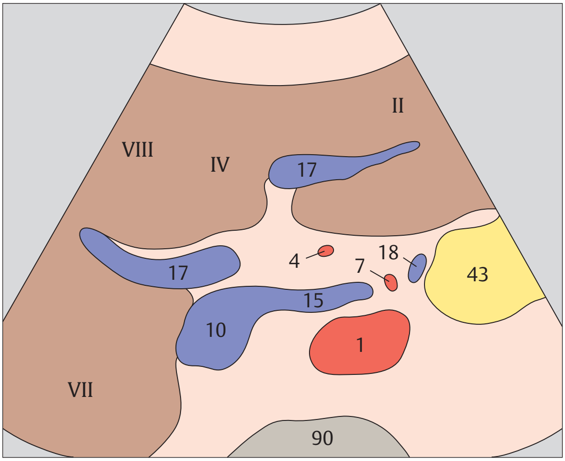
▶ **90** Medial and anterior hepatic segments, right and left portal vein branches




IV
VIII
II
12
17
11
17
4
5
43
7
10
1
VII
96
90

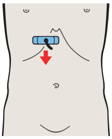
The division of the portal vein into right and left branches marks the approximate boundary between the upper and lower subsegments.

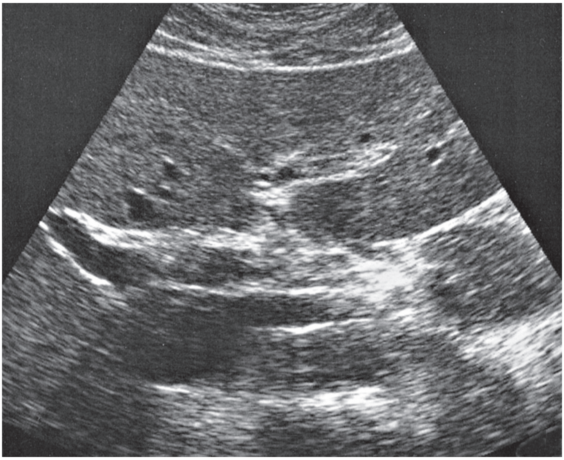
◀


II
VIII
IV
17
17
4
18
7
43
15
10
1
VII
90

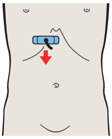
The division of the portal vein into right and left branches shows an antler-like configuration on ultrasound.

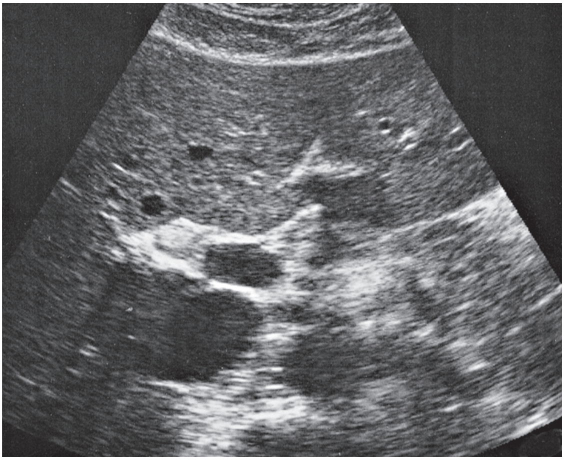
◀



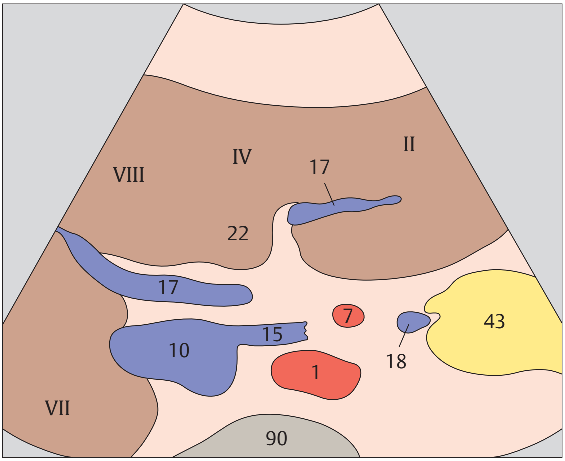


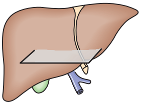
▶ **91** Medial and anterior hepatic segments, right and left portal vein branches



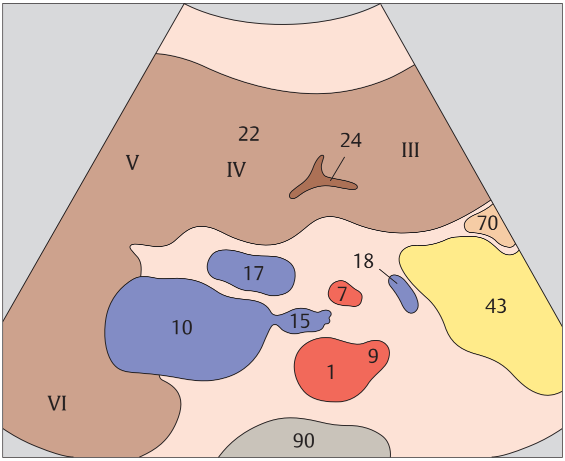


▶ **92** Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, portal vein

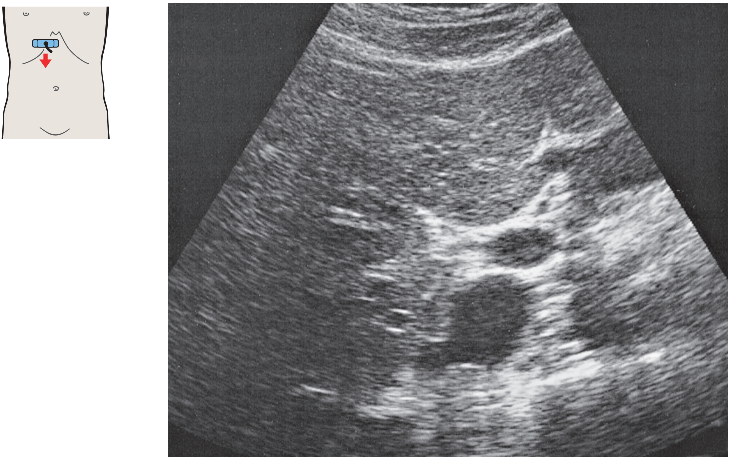

VIII
IV
17
II
22
17
7
15
10
18
43
1
VII
90



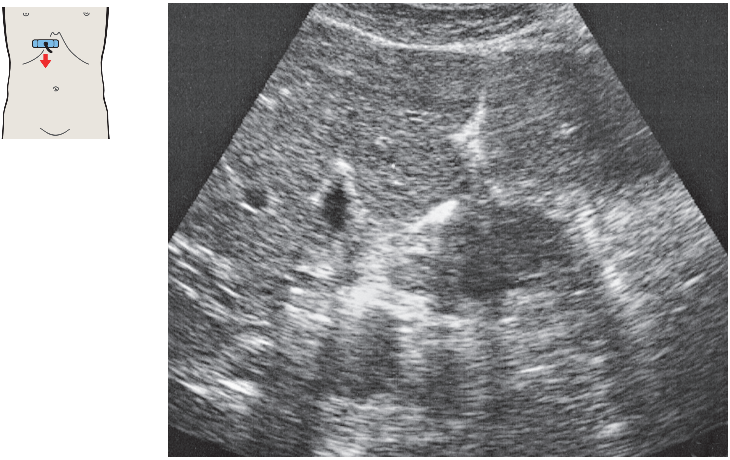
The right portal vein branch initially runs slightly caudally from the bifurcation.


22
24
III
V
IV
70
18
17
7
43
15
10
9
1
VI
90

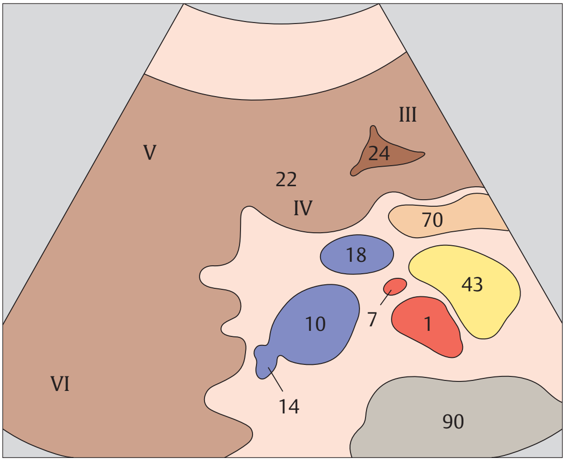
Ligamentum teres marks the boundary plane between the right and left lobes of the liver.

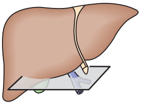


▶ **93** Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, portal vein

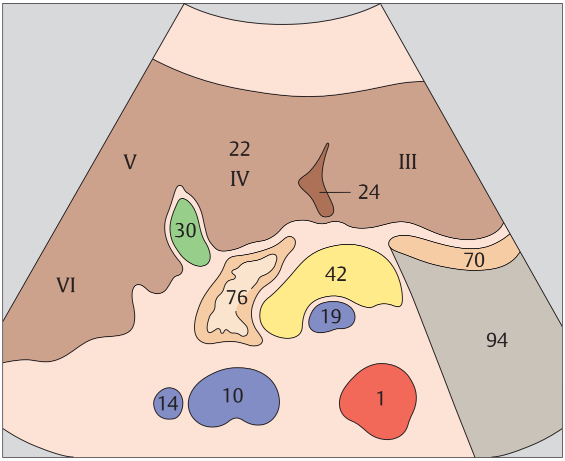


▶ **94** Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, gallbladder

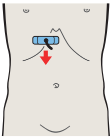

III
V
24
22
IV
70
18
43
10
7
1
VI
14
90

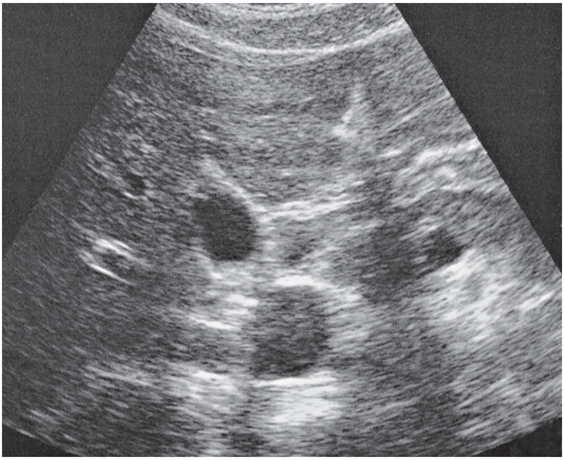


The lower subsegments of the lateral, medial, anterior, and posterior hepatic segments are designated, respectively, subsegments III, IVb, V, and VI. ◀

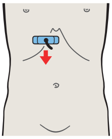

22
V
IV
III
24
30
VI
70
42
76
19
94
14
10
1

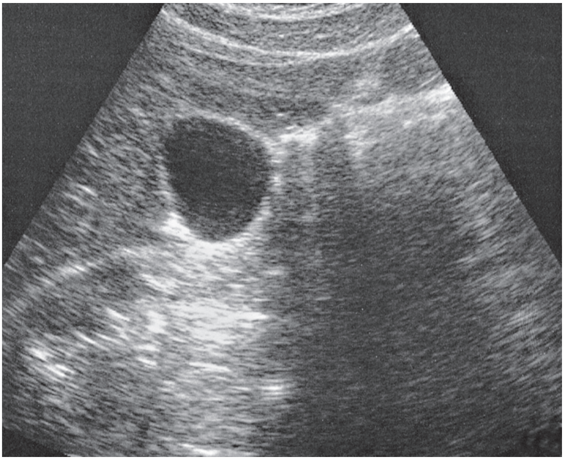
The gallbladder and ligamentum teres form the boundary structures of the quadrate lobe in transverse section. ◀



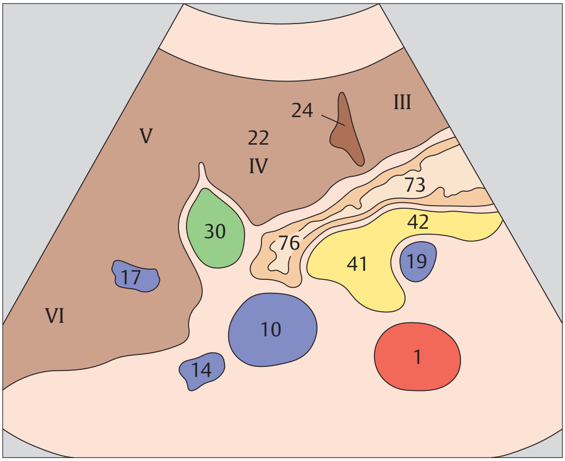


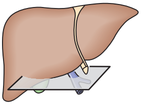
▶ **95** Medial and anterior hepatic segments, quadrate lobe, ligamentum teres, gallbladder



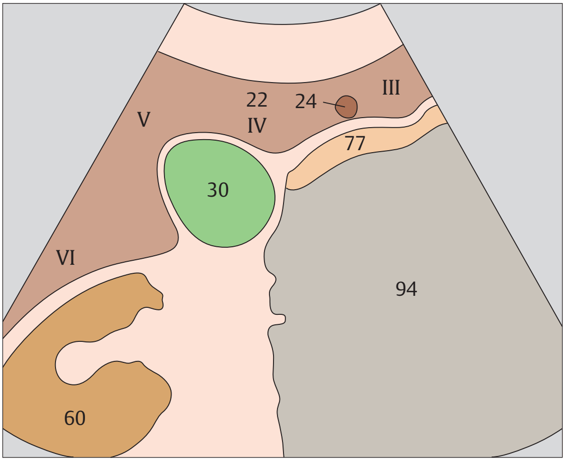


▶ **96** Inferior border of liver, kidney, gallbladder, ligamentum teres

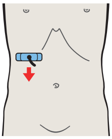

24
III
V
22
IV
73
30
42
76
41
19
17
VI
10
1
14

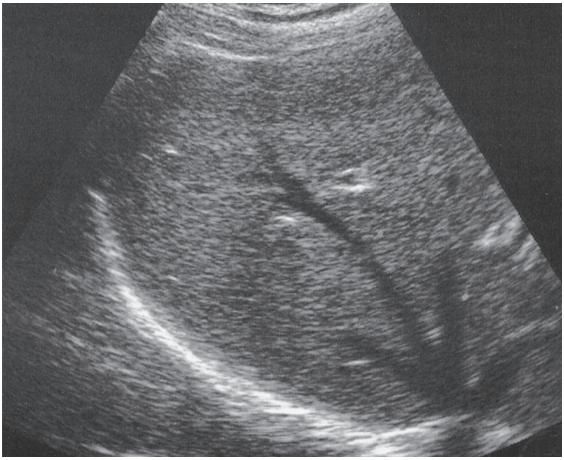


The vena cava–gallbladder plane marks the boundary between the right and left lobes of the liver based on functional criteria.

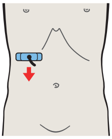

III
22
24
V
IV
77
30
VI
94
60

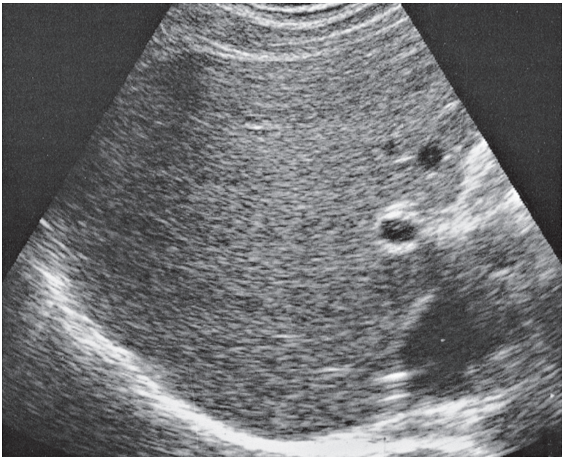
The shape of the inferior hepatic border is influenced by the kidney, the gallbladder, and the groove for ligamentum teres.



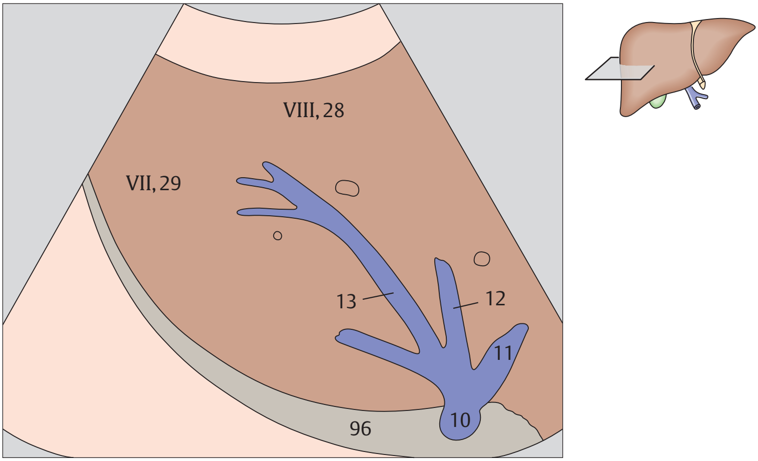


▶ **97** Posterior segment, upper subsegment

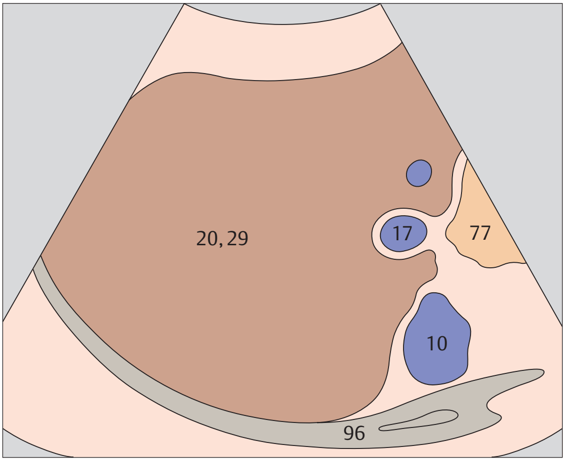




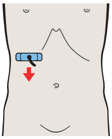
▶ **98** Posterior segment, portal vein

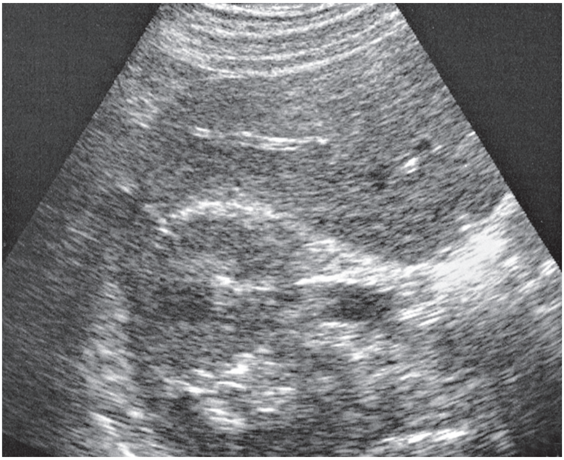

VIII, 28
VII, 29
13
12
11
10
96

The upper subsegment of the posterior hepatic segment is designated as subsegment VII.

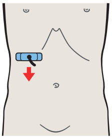

20, 29
17
77
10
96

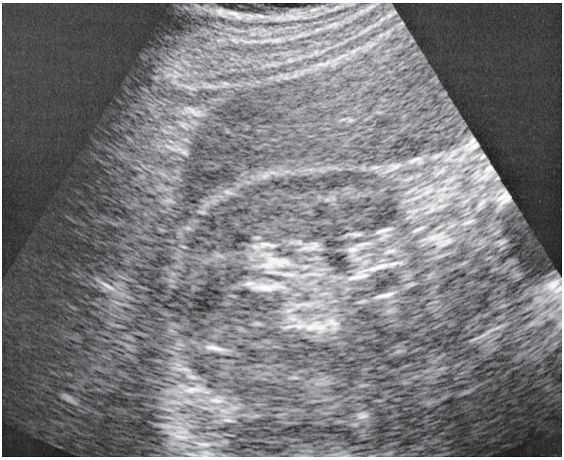
The right portal vein branch marks the approximate boundary between subsegment VII cranially and subsegment V caudally.



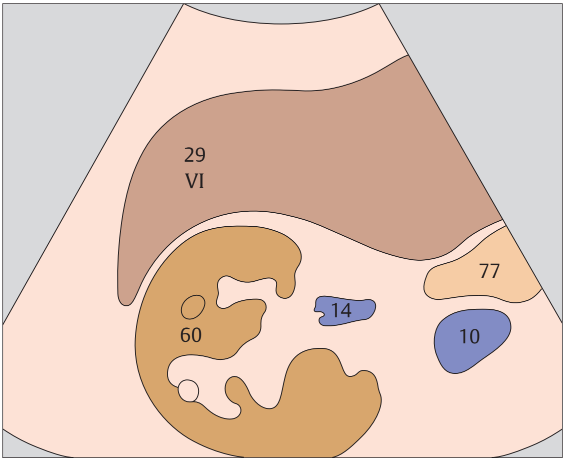


▶ **99** Posterior segment, lower subsegment, kidney





▶ **100** Posterior segment, inferior border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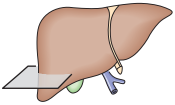
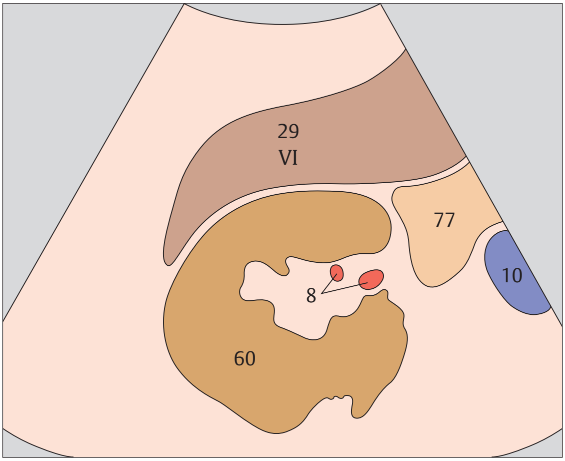


The lower subsegment of the posterior hepatic segment is designated as subsegment VI. ◀


29
VI
77
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8
60

The right lobe of the liver is highly variable in its inferior extent. ◀

3 Gallbladder

Gallbladder in Upper Abdominal Transverse Sections

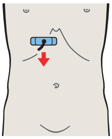
101 Right portal vein branch, ligamentum venosum
102 Gallbladder neck
103 Junction of neck and body of gallbladder
104 Body of gallbladder
105 Gallbladder fundus
106 Gallbladder fundus, inferior border

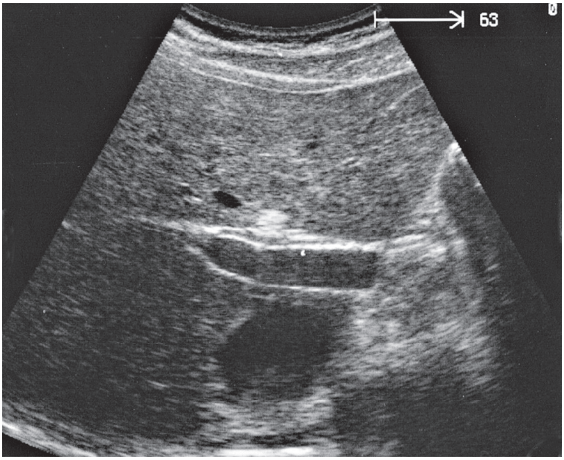
Gallbladder in Longitudinal Sections

107 Vena cava, duodenum, bifurcation of portal vein
108 Right portal vein branch, duodenum, gallbladder body
109 Right portal vein branch, body and neck of gallbladder
110 Body and fundus of gallbladder, kidney
111 Gallbladder fundus, kidney
112 Gallbladder fundus, kidney

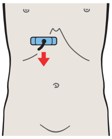
Details of the Gallbladder

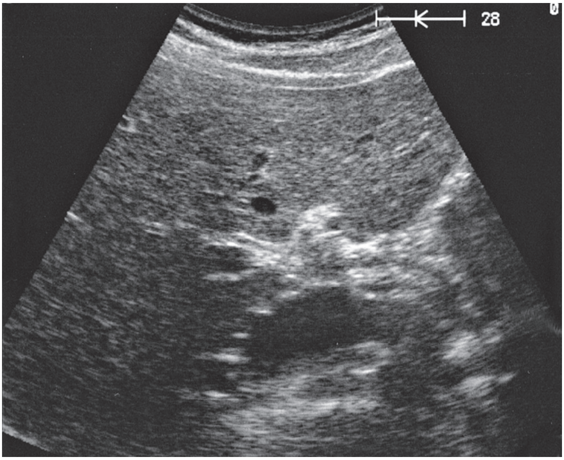
113 Regions of the gallbladder, spiral folds
114 Layers of the gallbladder wall



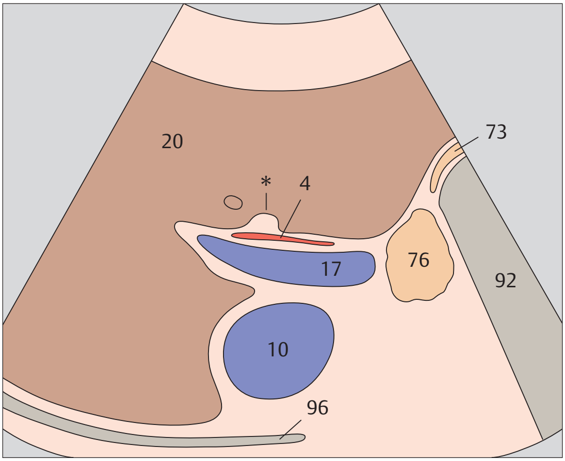


▶ **101** Right portal vein branch, ligamentum venosum





▶ **102** Gallbladder neck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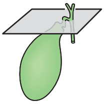
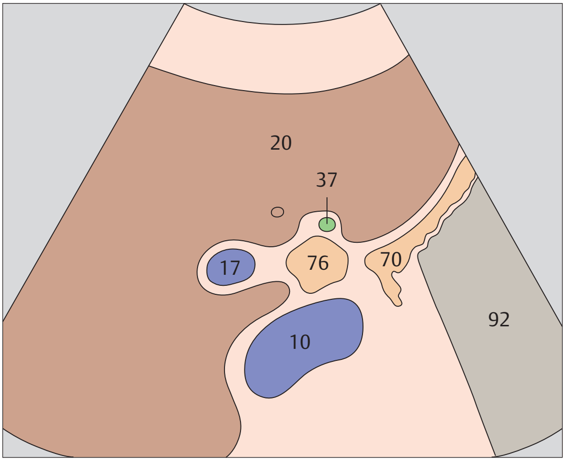


The interlobar fissure (*), located anterior to the right portal vein branch, is the landmark for identifying the gallbladder.

◀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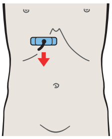
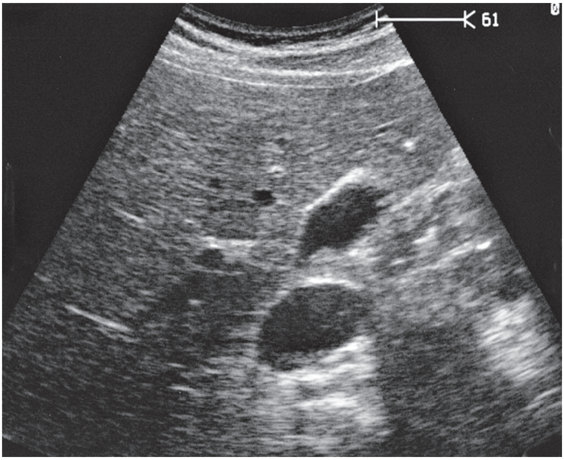
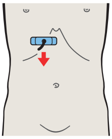
The neck of the gallbladder is located just caudal to the right portal vein branch and the interlobar fissure.

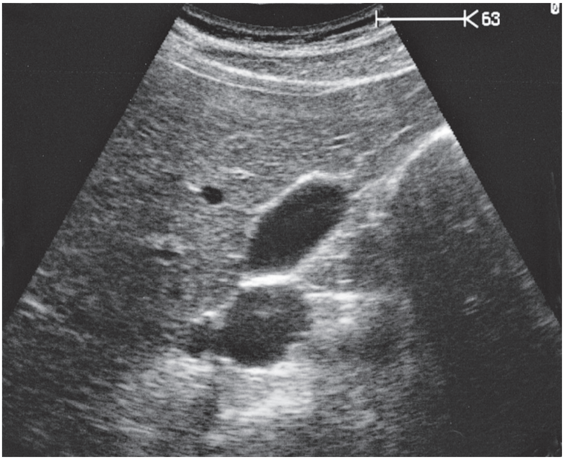
◀



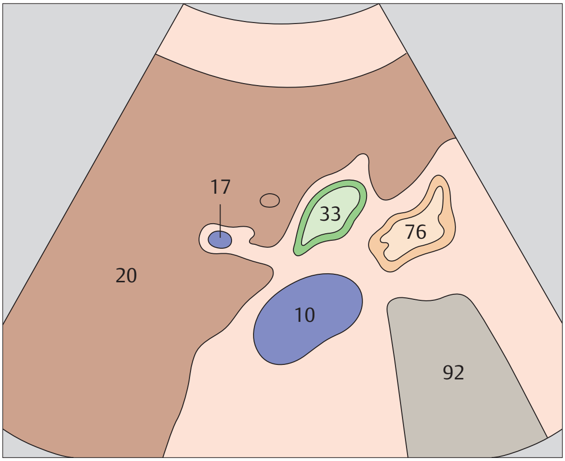


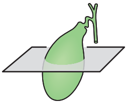
▶ **103** Junction of neck and body of gallbladder





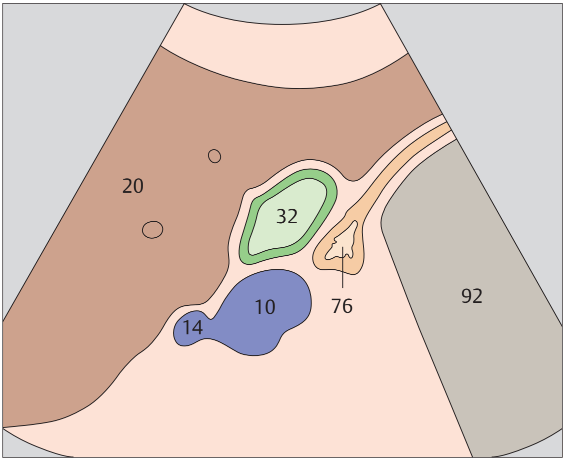
▶ **104** Body of gallbladder





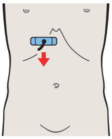
In a transverse scan through the body of the gallbladder, the duodenum is located between the gallbladder and the vena cava.

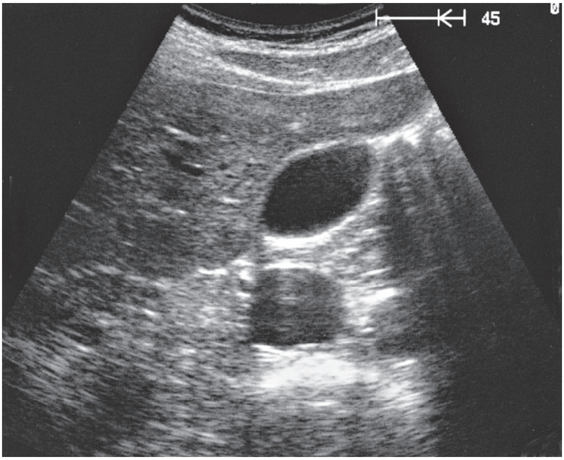
◀



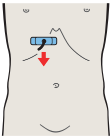
The duodenal bulb can consistently be identified on the free peritoneal side of the body or neck of the gallbladder.

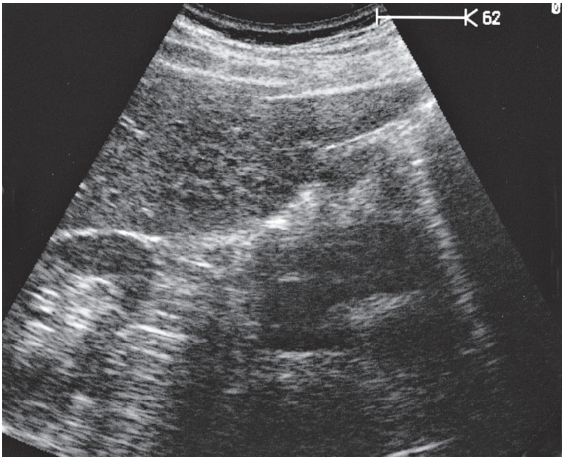
◀



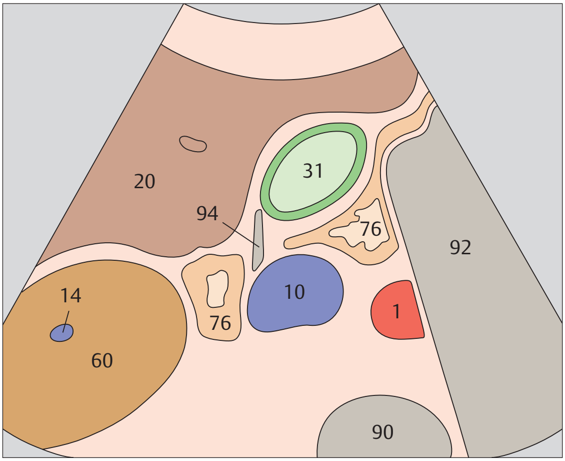


▶ **105** Gallbladder fundus





▶ **106** Gallbladder fundus, inferior border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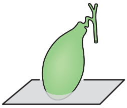
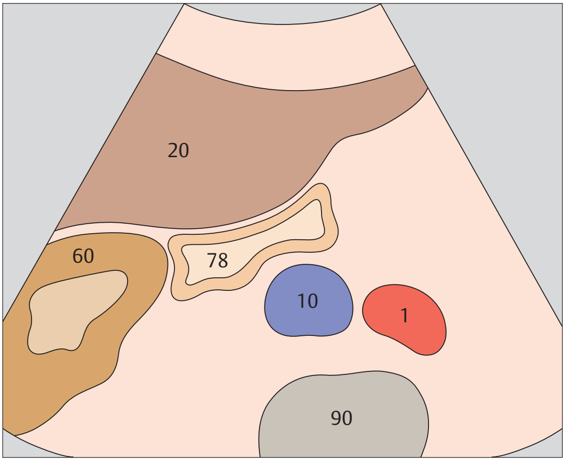


The gallbladder fundus may extend almost to the anterior abdominal wall, but it may also be placed very deeply behind the liver.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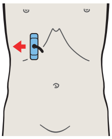
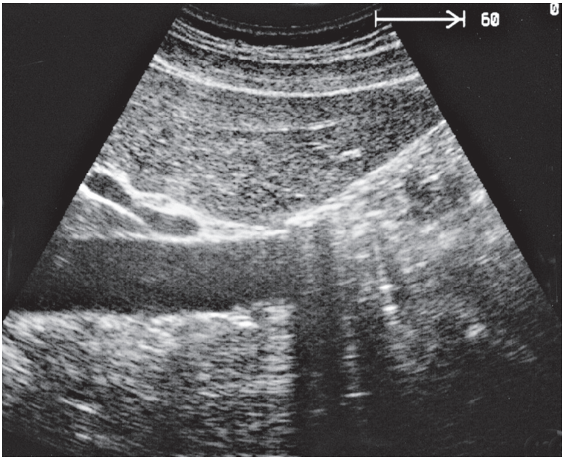
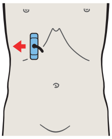
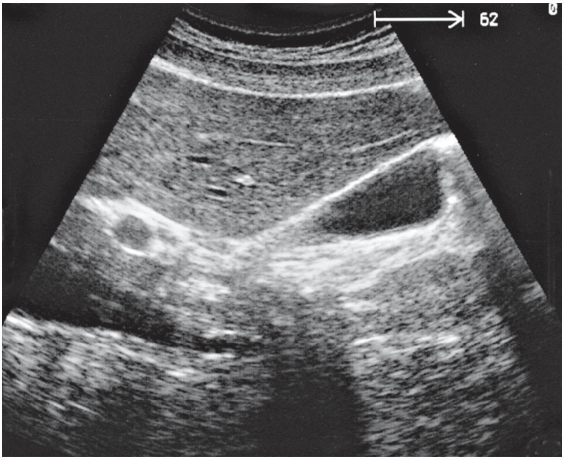
The right colic flexure often impresses on the caudal surface of the gallbladder fundus.



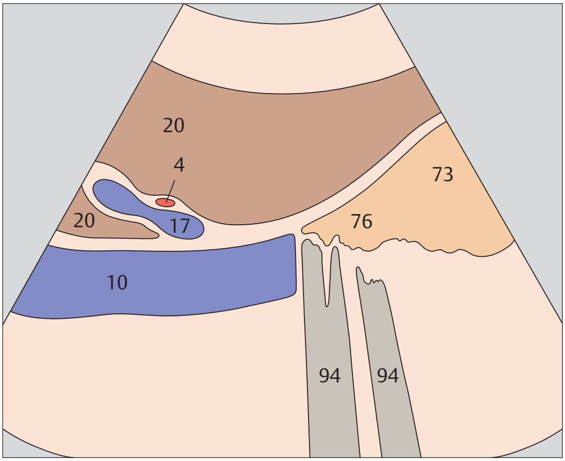


▶ **107** Vena cava, duodenum, bifurcation of portal vein





▶ **108** Right portal vein branch, duodenum, gallbladder body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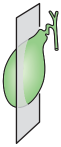
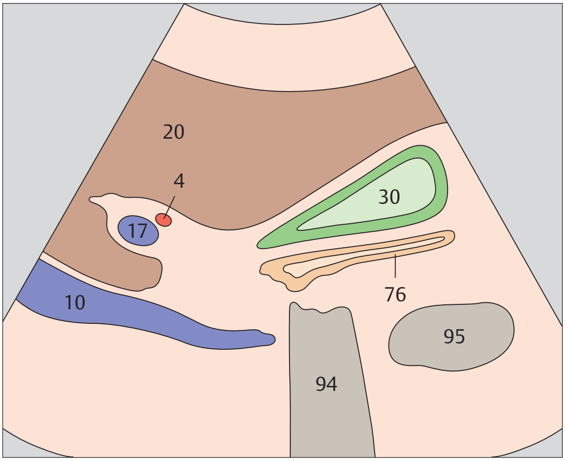


The vena cava, the portal bifurcation, and the echodense band of the interlobar fissure provide conspicuous landmarks for locating the gallbladder in longitudinal section.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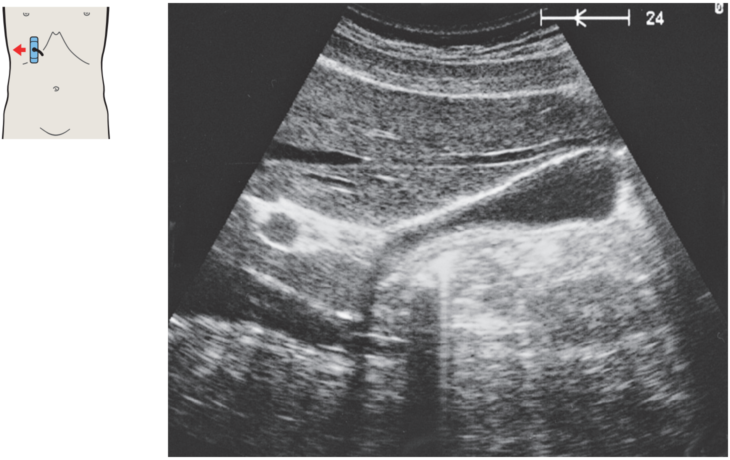
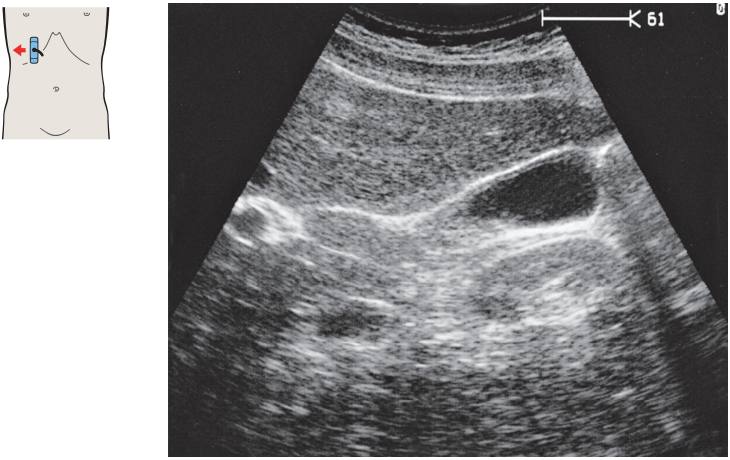
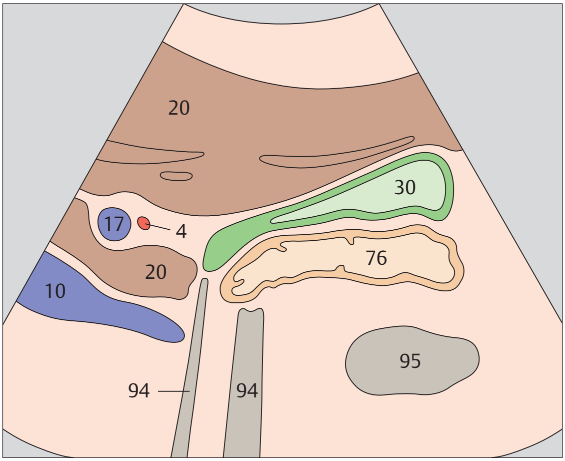
The duodenum is adjacent to the gallbladder posteriorly and to the right colic flexure caudally.



▶ **109** Right portal vein branch, body and neck of gallbladder



▶ **110** Body and fundus of gallbladder, kidney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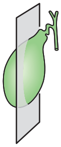
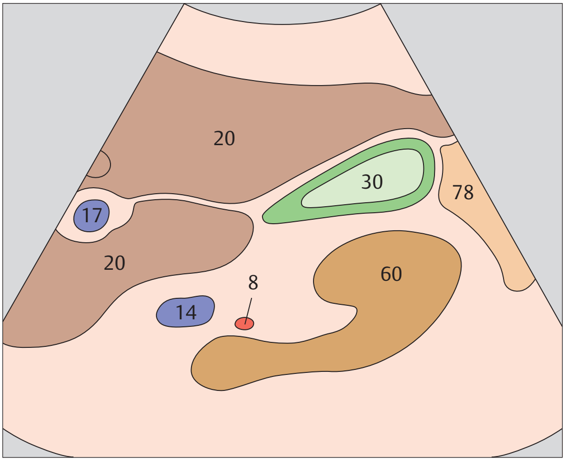


The shape and position of the gallbladder are highly variable. However, the neck of the gallbladder is always located in the porta hepatis, caudal to the right portal vein branch.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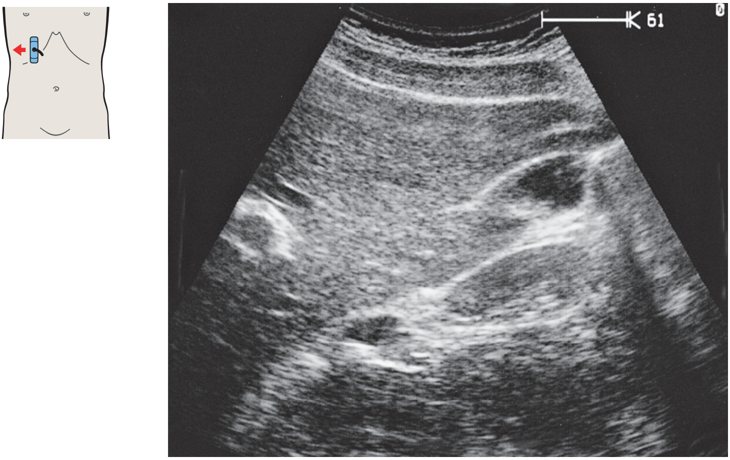
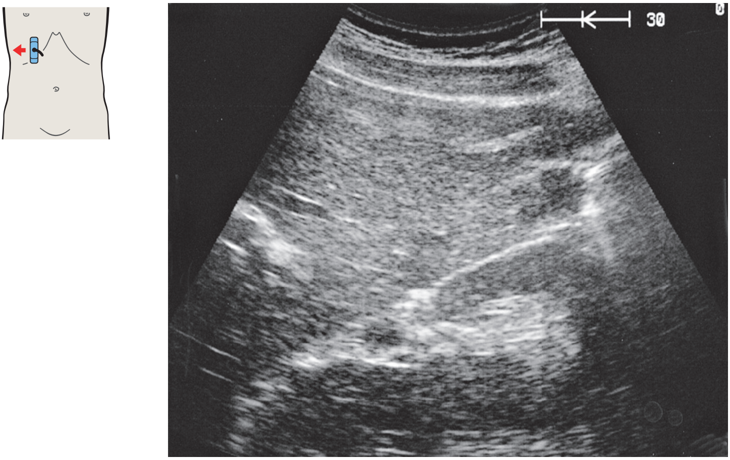
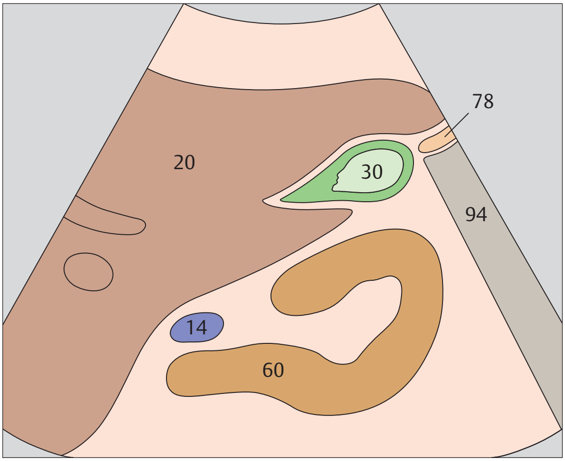
The healthy gallbladder is typically a pear-shaped, fluid-filled organ that contains no internal echoes.



▶ **111** Gallbladder fundus, kidney



▶ **112** Gallbladder fundus, kidney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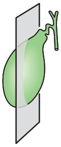
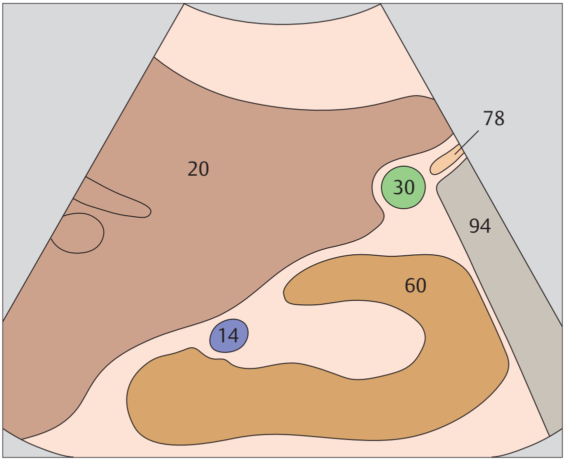


A wedge of liver tissue, variable in size, is interposed between the gallbladder and kidney in longitudinal section.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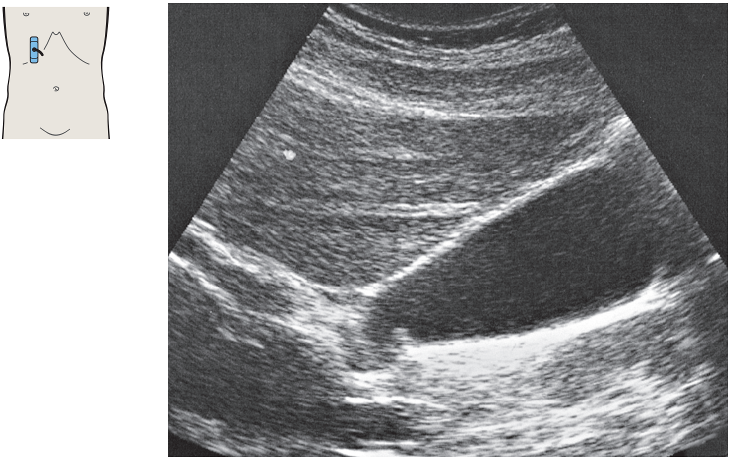
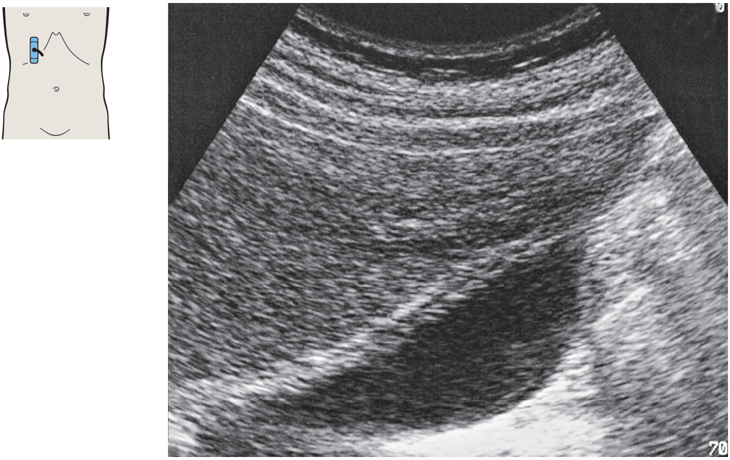
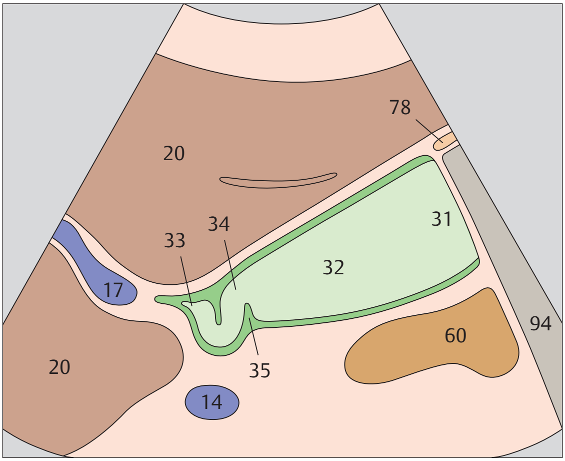
In a more lateral scan, the gallbladder may be in direct contact with the kidney.



▶ **113** Regions of gallbladder, spiral folds



▶ **114** Layers of gallbladder wall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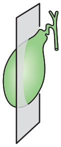
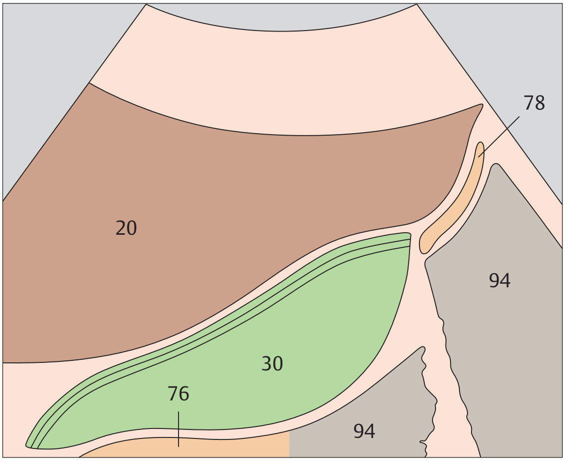


The spiral folds and gallbladder neck are often clearly visualized in a lateral scan over the gallbladder.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The anterior wall of the gallbladder consists of three identifiable layers. Usually the posterior wall of the gallbladder is poorly demarcated from the duodenum.

4 Pancreas

Pancreas in Longitudinal Sections

115 Duodenum lateral to head of pancreas
116 Head of pancreas, bile duct
117 Head of pancreas, bile duct
118 Head of pancreas, hilar vessels, vena cava
119 Head of pancreas, superior mesenteric vein, uncinate process
120 Head of pancreas, superior mesenteric vein, uncinate process
121 Body of pancreas, splenic vein
122 Body of pancreas, splenic vein, superior mesenteric artery, aorta
123 Body of pancreas, splenic vein
124 Tail of pancreas, splenic artery and vein, renal artery and vein
125 Tail of pancreas, splenic artery and vein, renal artery and vein
126 Tail of pancreas

Head of the Pancreas in Transverse Sections

127 Section cranial to head of pancreas, vena cava, splenic vein
128 Head of pancreas, vena cava, superior mesenteric vein
129 Head of pancreas, vena cava, superior mesenteric vein, uncinate process, common bile duct
130 Head of pancreas, vena cava, superior mesenteric vein, uncinate process, gallbladder

Body of the Pancreas in Transverse Sections

131 Scan cranial to body of pancreas, celiac trunk
132 Body of pancreas, splenic vein
133 Body of pancreas, splenic vein, superior mesenteric artery, aorta
134 Left renal artery and vein, superior mesenteric artery and vein, aorta

Tail of the Pancreas in Transverse Sections

135 Tail of pancreas, splenic artery
136 Tail of pancreas, splenic vein
137 Tail of pancreas, gas in stomach
138 Tail of pancreas

Transsplenic View of the Tail of the Pancreas in Longitudinal Sections

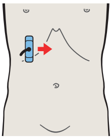
139 Scan posterior to tail of pancreas, spleen, kidney
140 Spleen, tail of pancreas, kidney
141 Spleen, tail of pancreas, kidney
142 Scan anterior to tail of pancreas, spleen, stomach

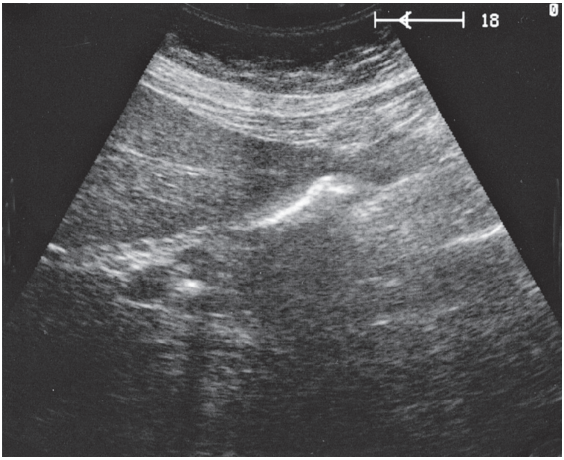
Transsplenic View of the Tail of the Pancreas in Transverse Sections

143 Spleen, tail of pancreas, kidney
144 Spleen, tail of pancreas, kidney

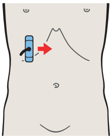
Details of the Pancreas

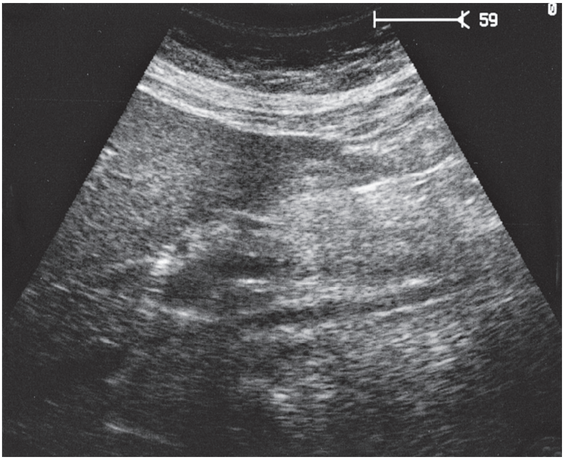
145 Transverse scan of pancreatic duct
146 Longitudinal scan of pancreatic duct



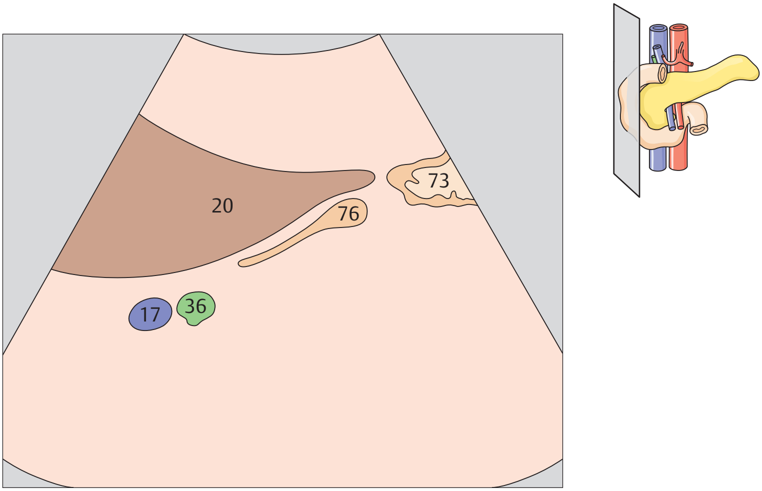


▶ **115** Duodenum lateral to head of pancreas





▶ **116** Head of pancreas, bile duct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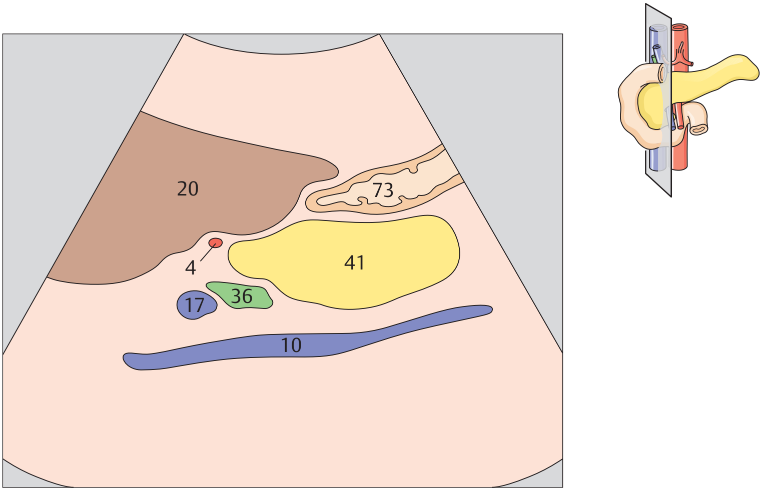
The head of the pancreas lies in the duodenal loop of the duodenum and is bounded laterally by the duodenum.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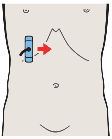
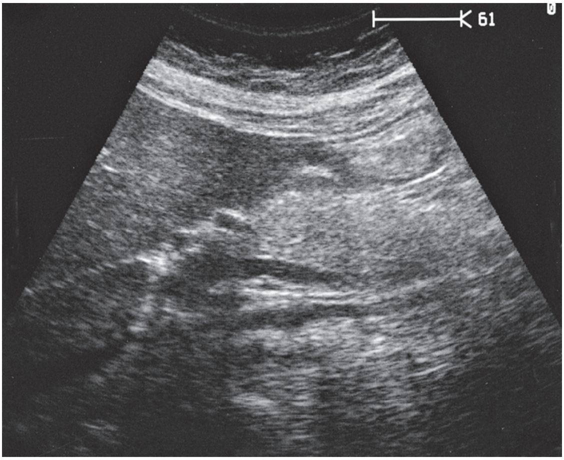
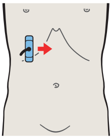
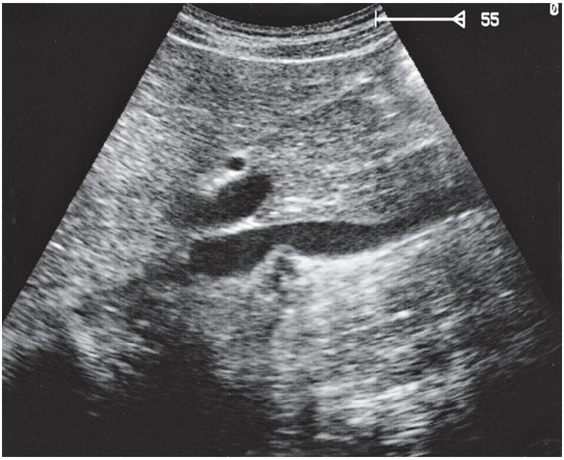
The bile duct, hepatic artery, and portal vein are located cranial to the head of the pancreas.



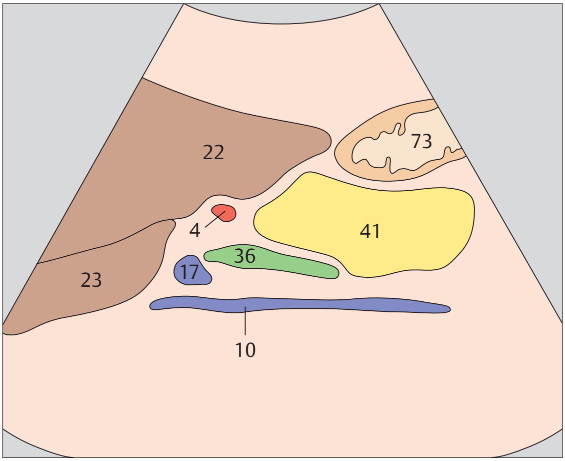


▶ **117** Head of pancreas, bile duct





▶ **118** Head of pancreas, hilar vessels, vena cava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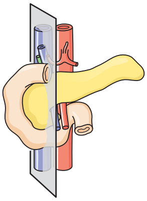
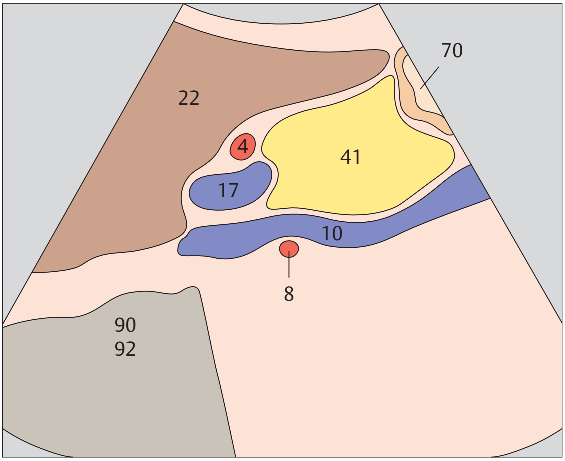


The bile duct runs posteriorly in the head of the pancreas to the papilla, which usually cannot be visualized with ultrasound. ◀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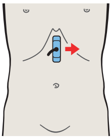
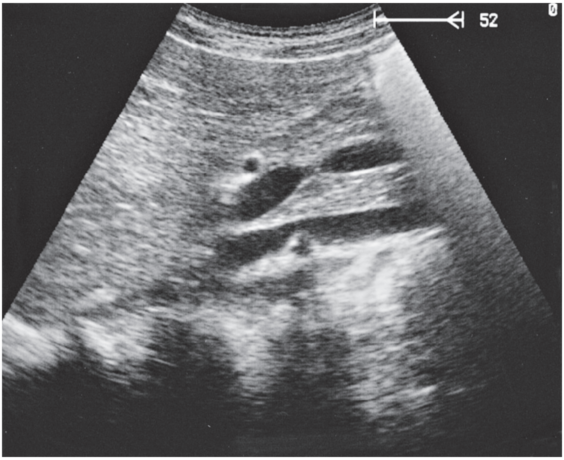
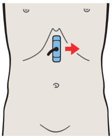
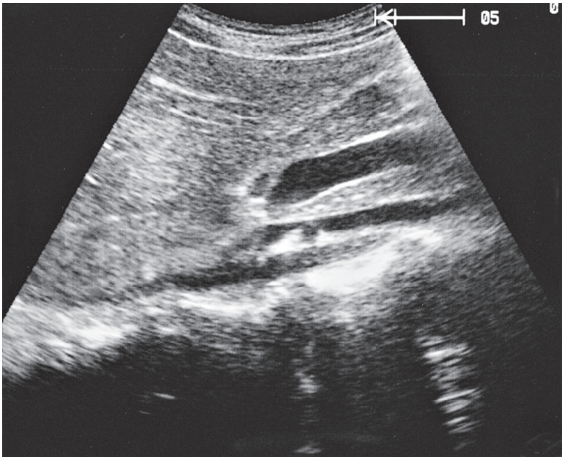
The head of the pancreas lies against the anterior surface of the vena cava and is bordered cranially by the main trunk of the portal vein. ◀



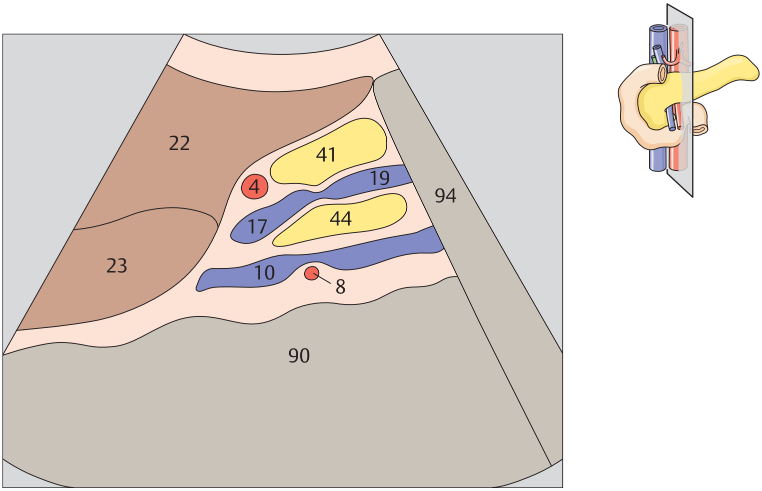


▶ **119** Head of pancreas, superior mesenteric vein, uncinate process





▶ **120** Head of pancreas, superior mesenteric vein, uncinate process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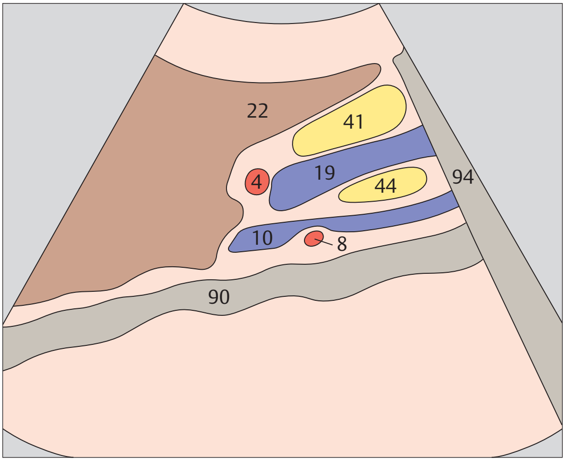
The uncinate process runs posteriorly around the mesenteric vein, coming between that vessel and the vena cava.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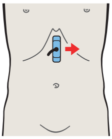
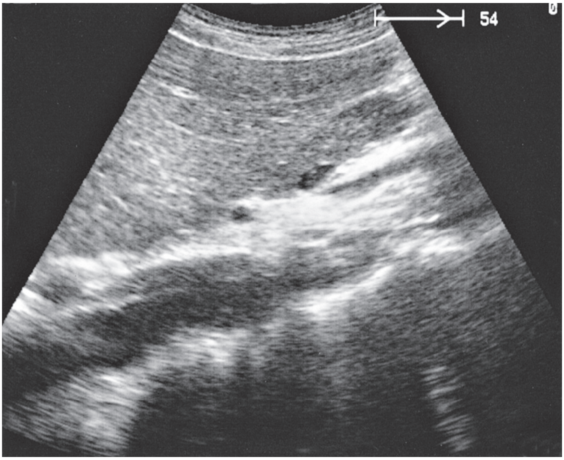
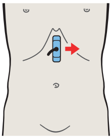
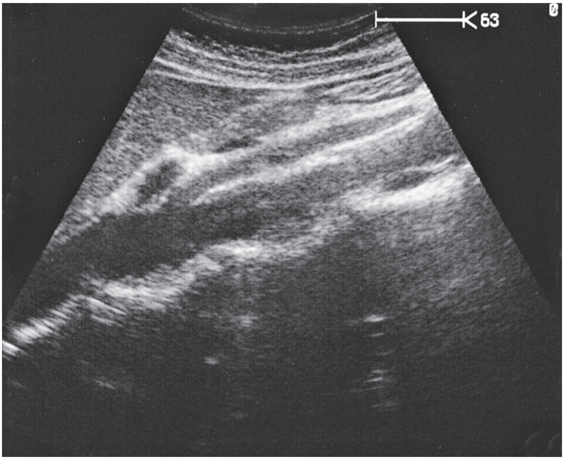
The superior mesenteric vein marks the boundary between the head and body of the pancreas.



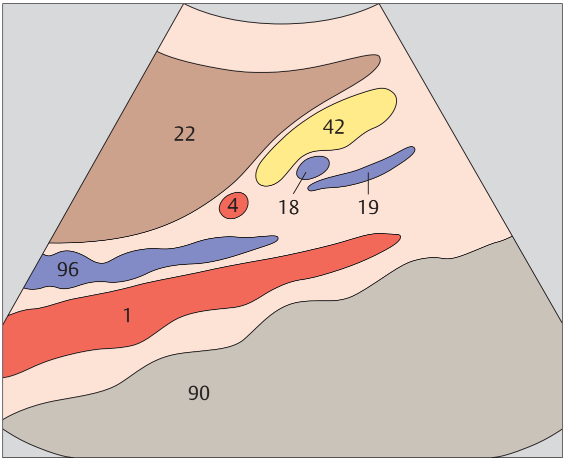


▶ **121** Body of pancreas, splenic vein





▶ **122** Body of pancreas, splenic vein,
superior mesenteric artery, aorta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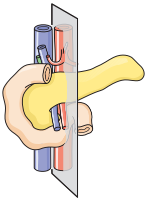
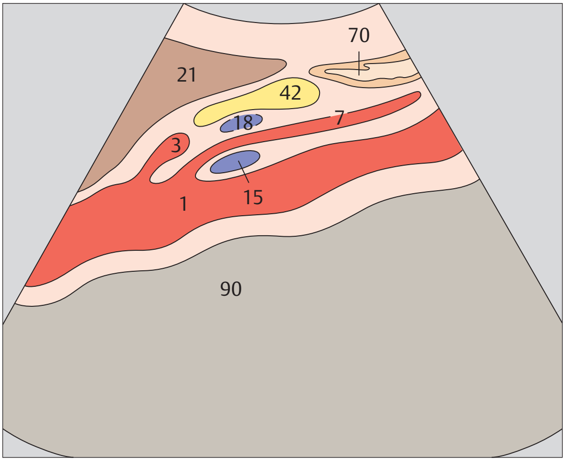


The body of the pancreas is the narrowest part of the organ in its ventrodorsal dimension.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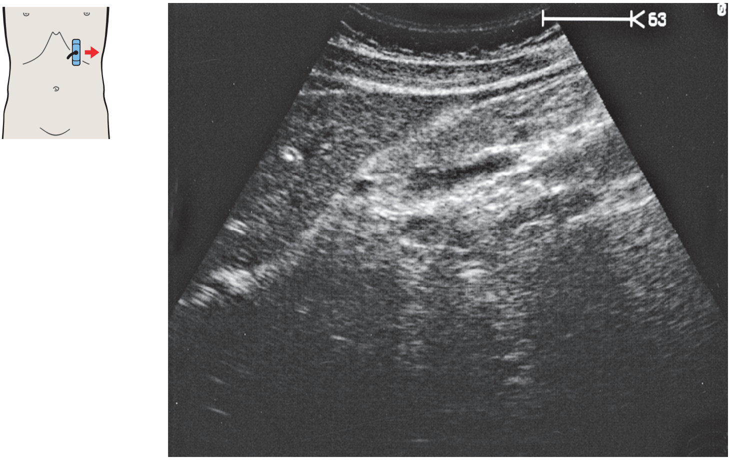
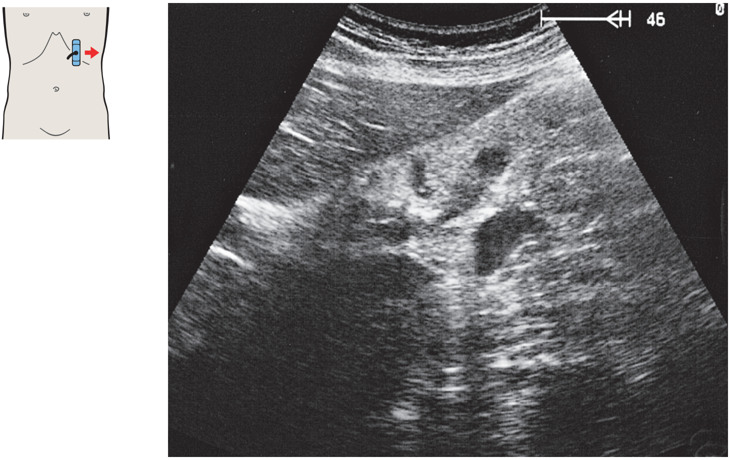
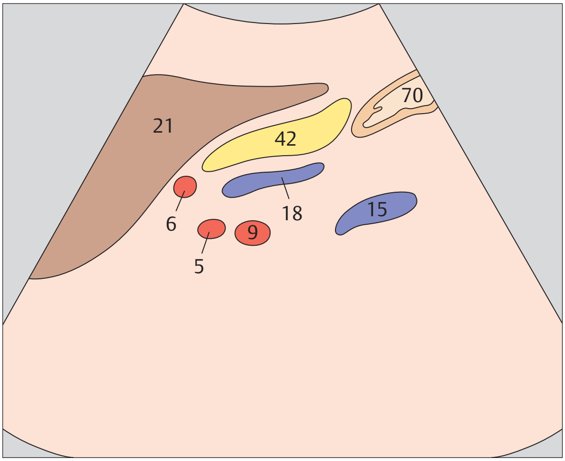
The celiac trunk is cranially adjacent to the body of the pancreas. The splenic vein and body of the pancreas cross over the superior mesenteric artery.

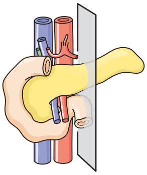


▶ **123** Body of pancreas, splenic vein

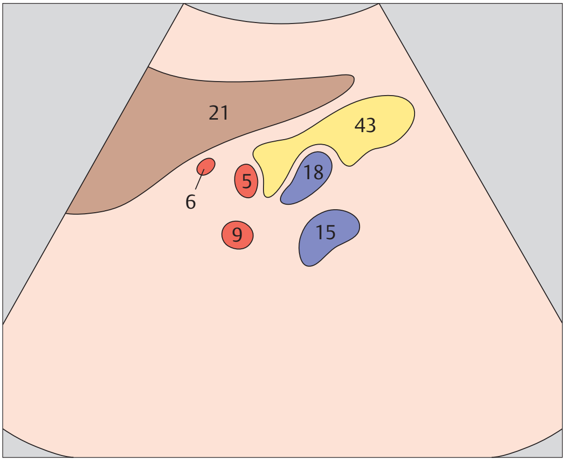


▶ **124** Tail of pancreas, splenic artery and vein, renal artery and vein

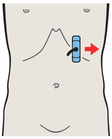


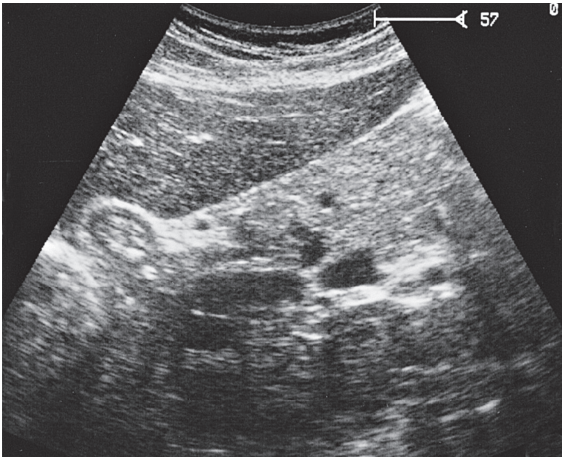


The left margin of the aorta marks the junction between the body and tail of the pancreas.

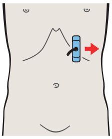


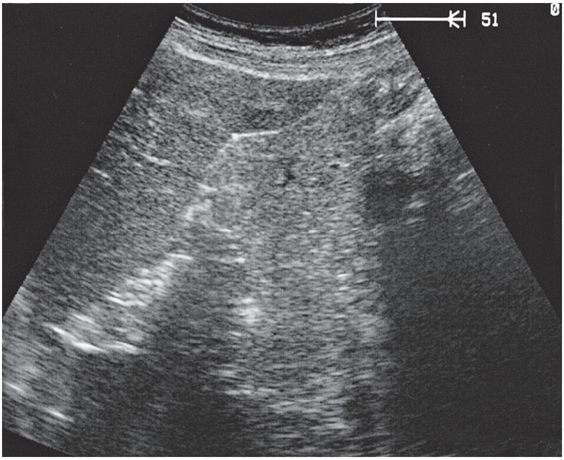
A longitudinal scan at the junction of the body and tail of the pancreas displays four vessels in cross section: the splenic artery, splenic vein, renal artery, and renal vein.



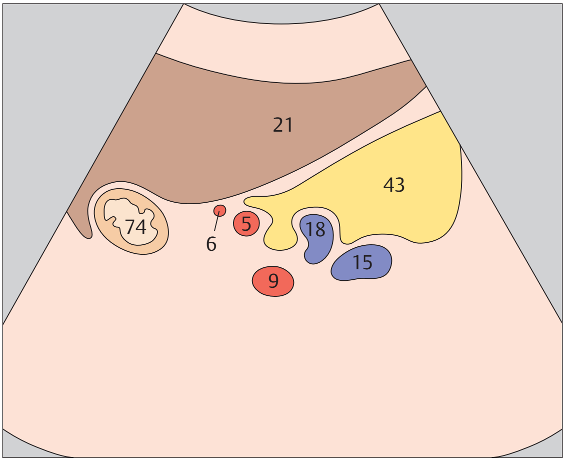


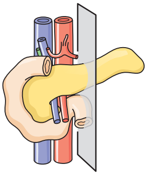
▶ **125** Tail of pancreas, splenic artery and vein, renal artery and vein



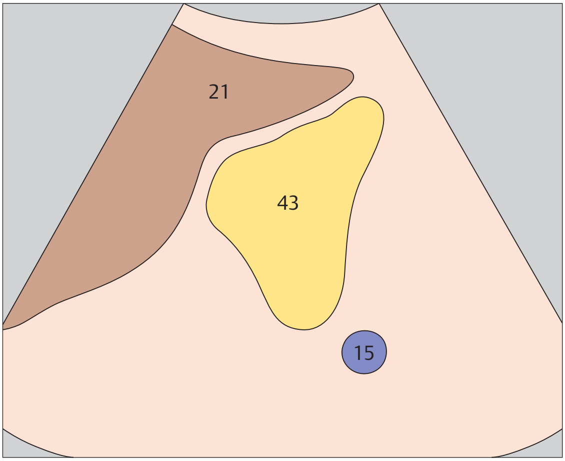


▶ **126** Tail of pancreas

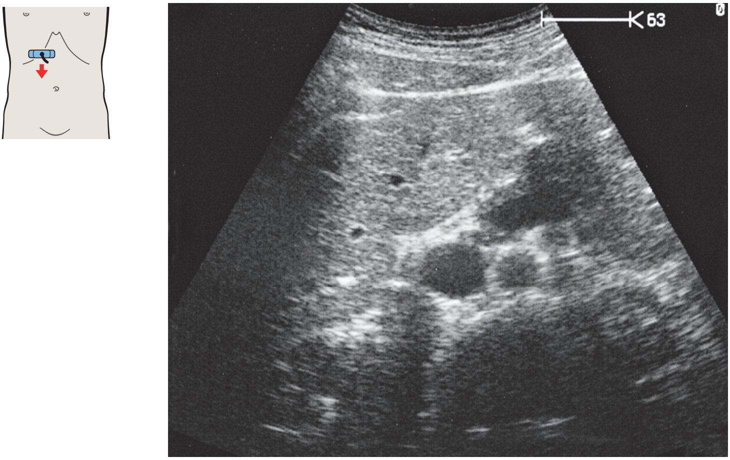




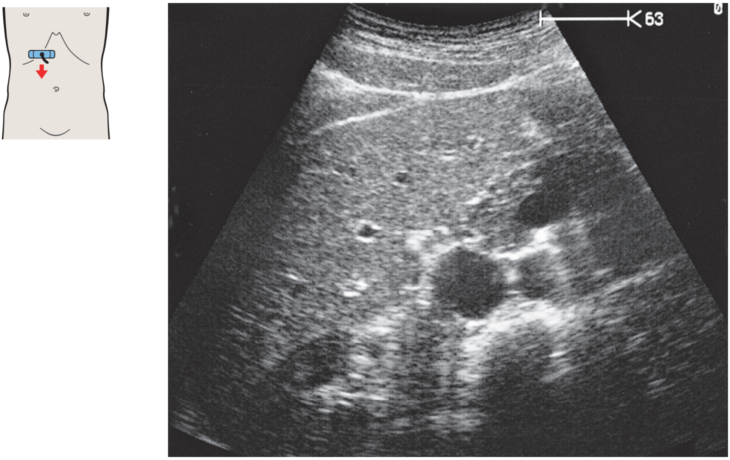
The tail of the pancreas often has a plump appearance in cross section. ◀



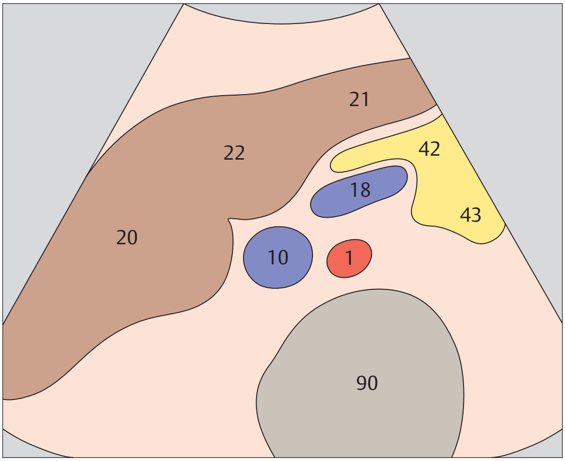
The tail of the pancreas can be completely visualized in an anterior scan only if acoustic conditions are good. ◀



▶ **127** Section cranial to head of pancreas, vena cava, splenic vein



▶ **128** Head of pancreas, vena cava, superior mesenteric vein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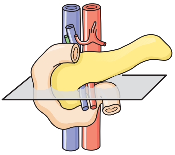
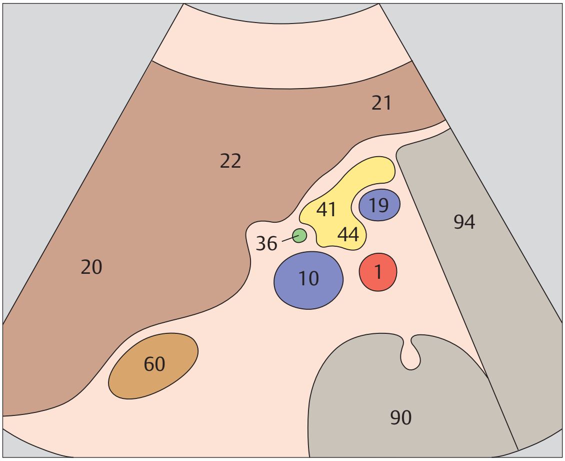


The body of the pancreas overlies the superior mesenteric vein. All parts of the gland that lie to the right of the superior mesenteric vein are designated as the head of the pancreas.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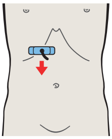
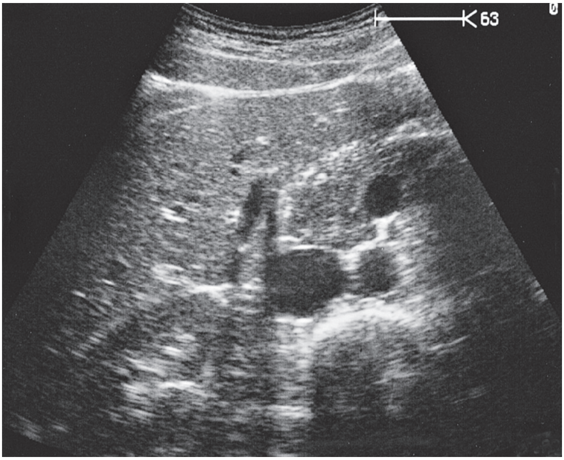
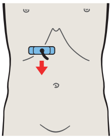
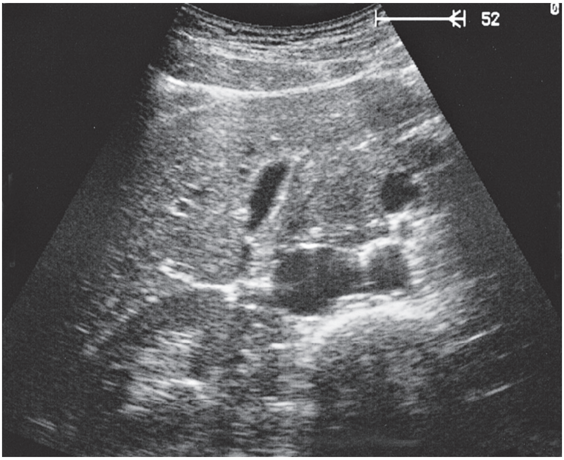
The uncinate process extends between the vena cava and superior mesenteric vein.



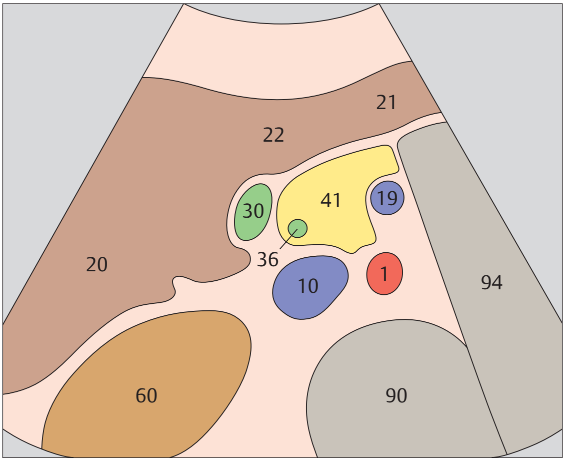


▶ **129** Head of pancreas, vena cava, superior mesenteric vein, uncinate process, common bile duct





▶ **130** Head of pancreas, vena cava, superior mesenteric vein, uncinate process, gallbladder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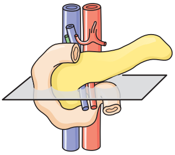
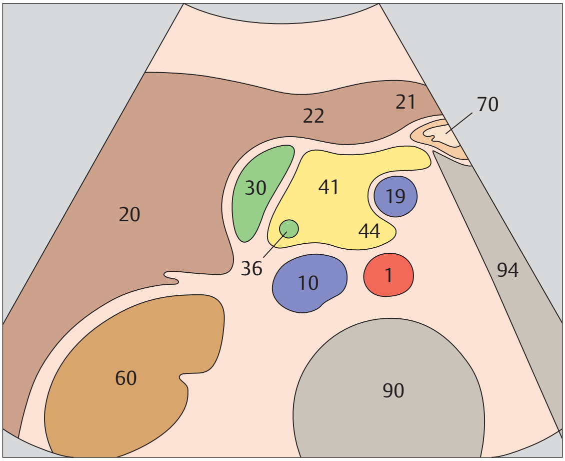


The common bile duct is visible at the right border of the pancreatic head in transverse section. ◀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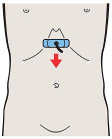
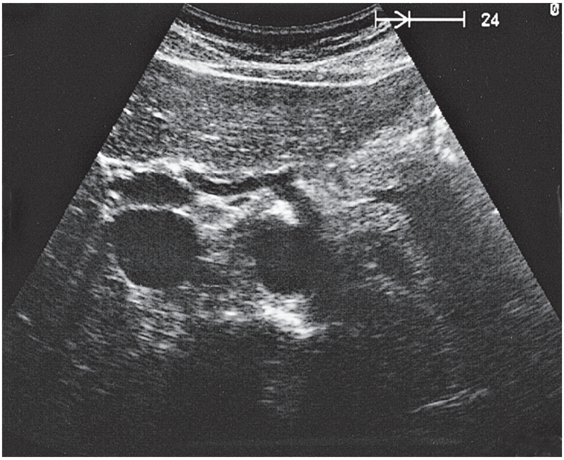
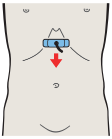
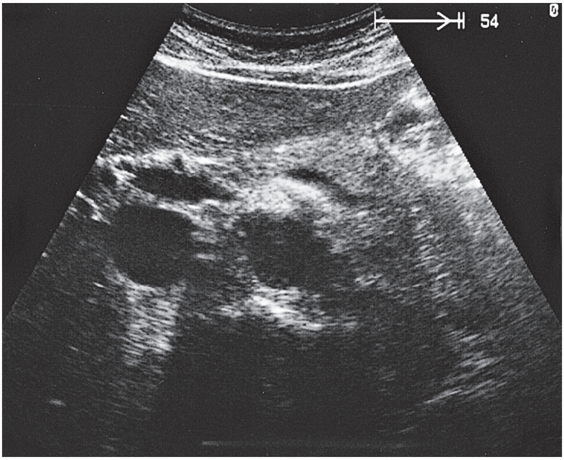
The head of the pancreas lies between the liver, gallbladder, vena cava, and superior mesenteric vein. ◀



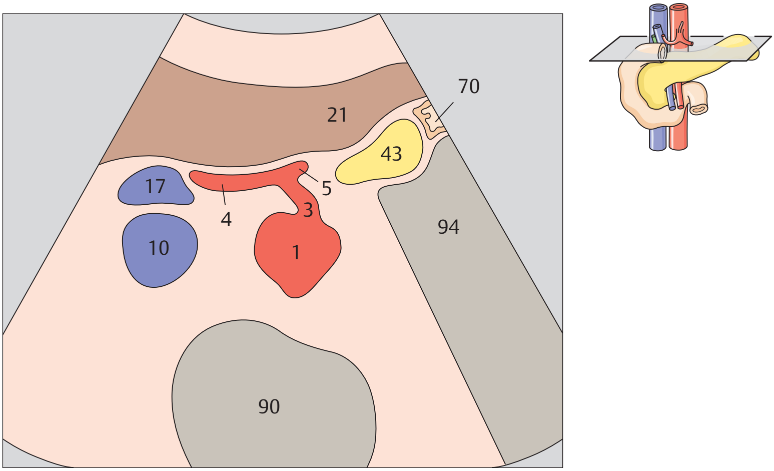


▶ **131** Scan cranial to body of pancreas, celiac trunk





▶ **132** Body of pancreas, splenic vein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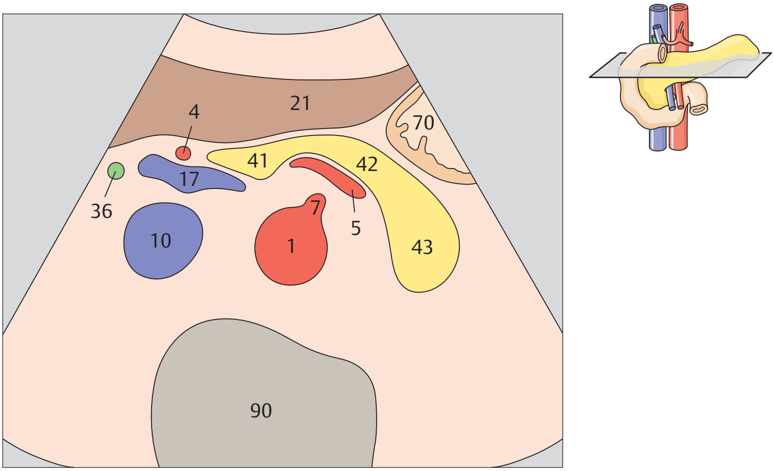
The body of the pancreas is bounded cranially by the celiac trunk and its two branches, the hepatic artery and splenic artery.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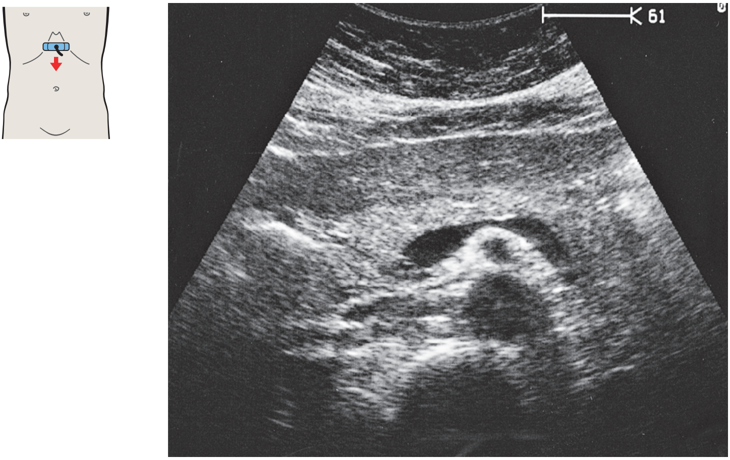
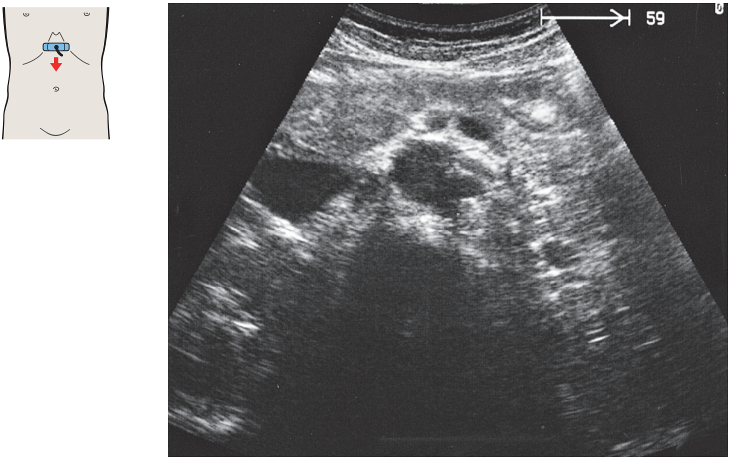
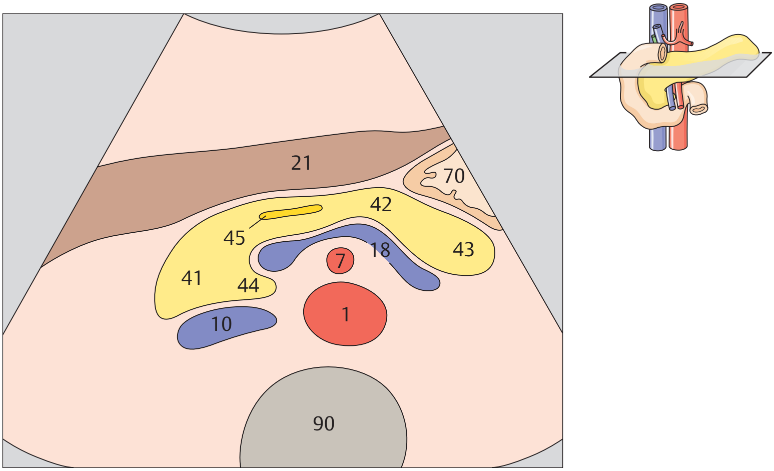
The borders of the healthy pancreas form a continuous outline from head to body to tail.



▶ **133** Body of pancreas, splenic vein,
superior mesenteric artery, aorta



▶ **134** Left renal artery and vein,
superior mesenteric artery and vein, aorta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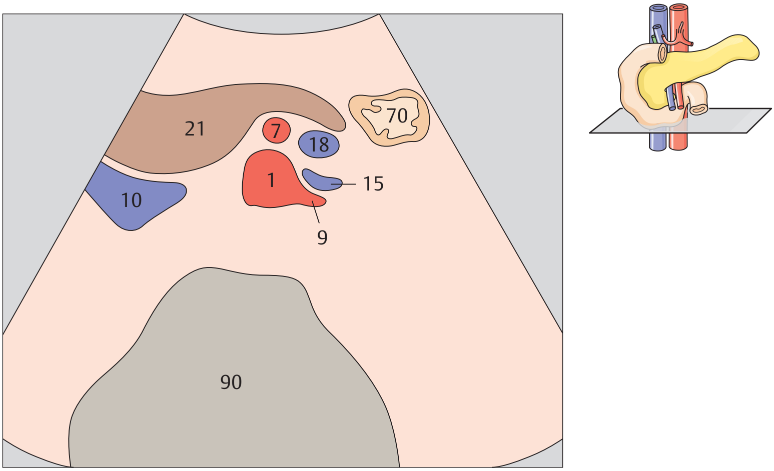
The splenic vein is the landmark for locating the pancreas. The superior mesenteric artery lies between the splenic vein and the aorta, appearing as an echo-free spot surrounded by bright echoes.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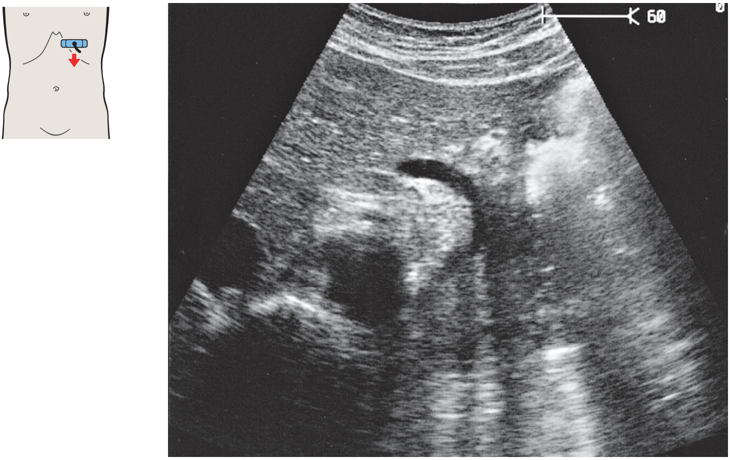
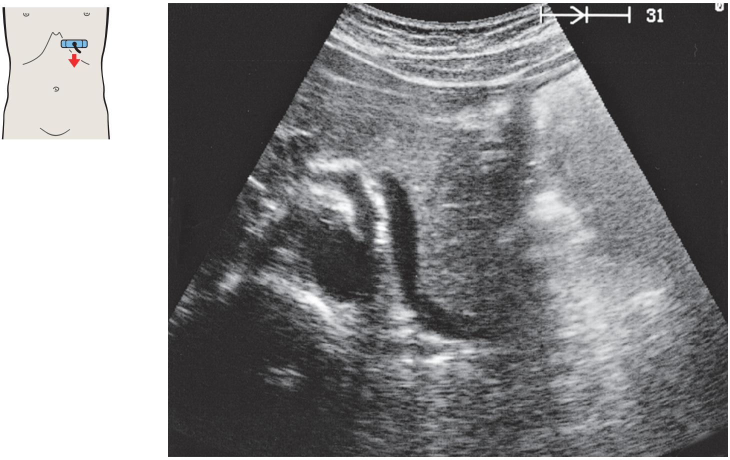
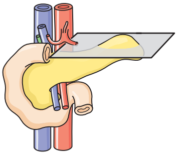
When the renal vessels are displayed in a transverse scan, usually the pancreas is no longer visualized.

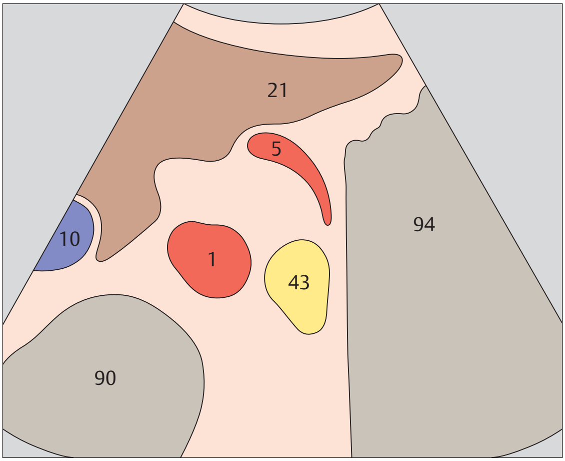


▶ **135** Tail of pancreas, splenic artery

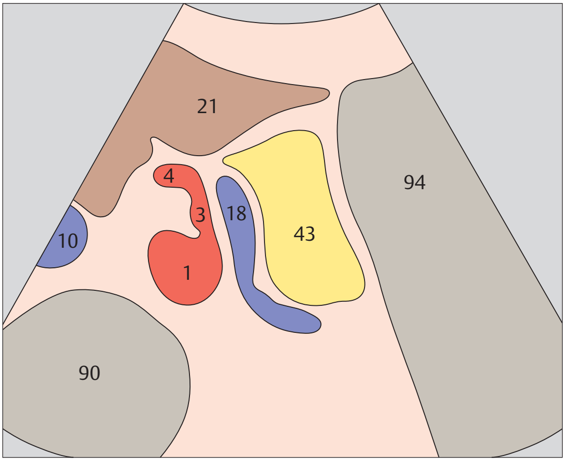


▶ **136** Tail of pancreas, splenic vein

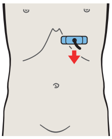


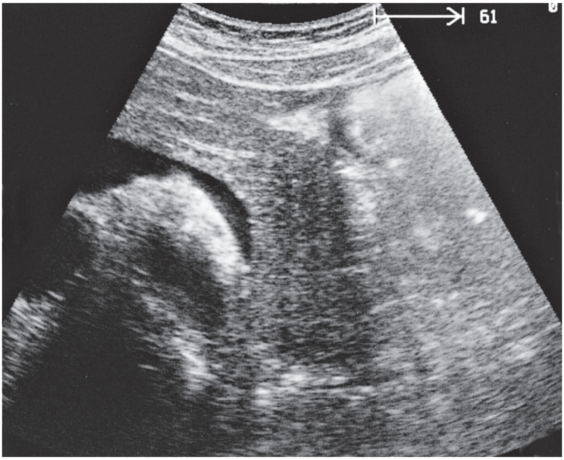


The tail of the pancreas is located well posteriorly, on the left side of the aorta. ◄

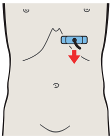


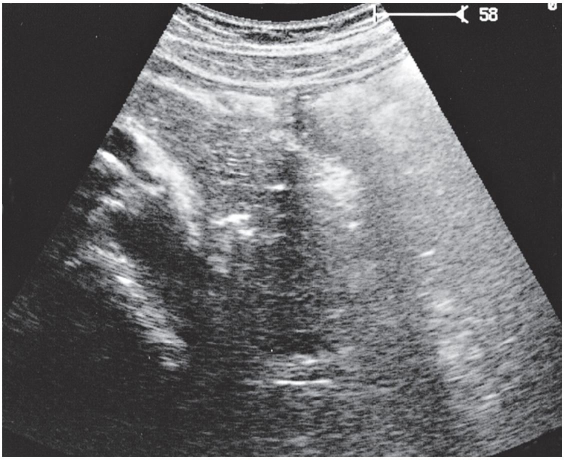
The tail of the pancreas is angled sharply posterior from the body and extends a variable distance between the stomach and the upper renal pole toward the splenic hilum. ◄



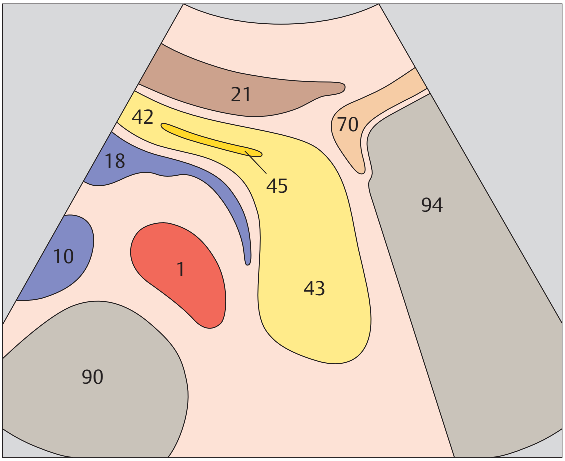


▶ **137** Tail of pancreas, gas in stomach





▶ **138** Tail of pancreas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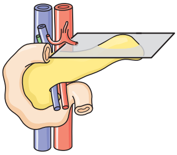
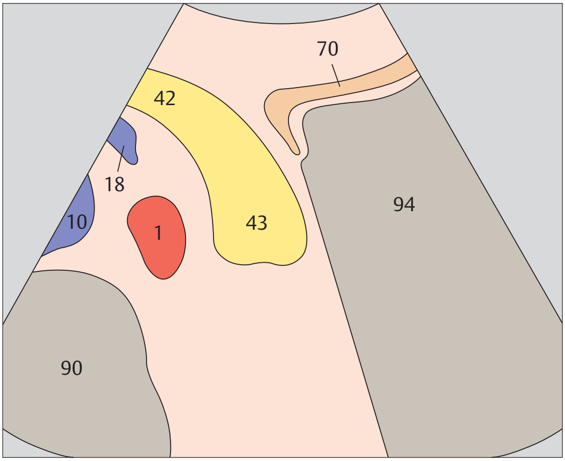


The junction between the body and tail of the pancreas is located at the level of the left aortic margin.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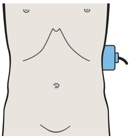
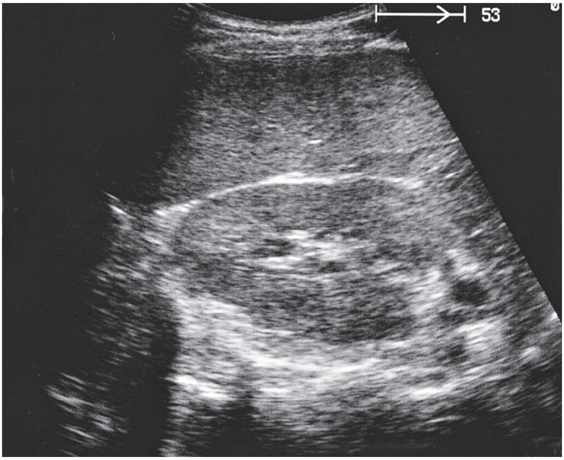
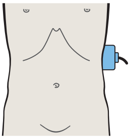
1
43
94
90

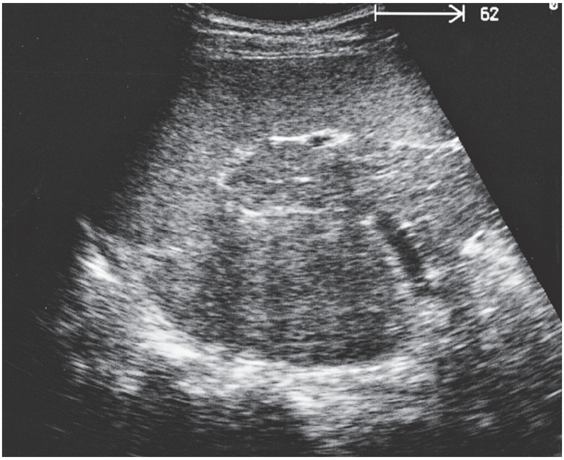
The tail of the pancreas is the most difficult part of the gland to evaluate with ultrasound.



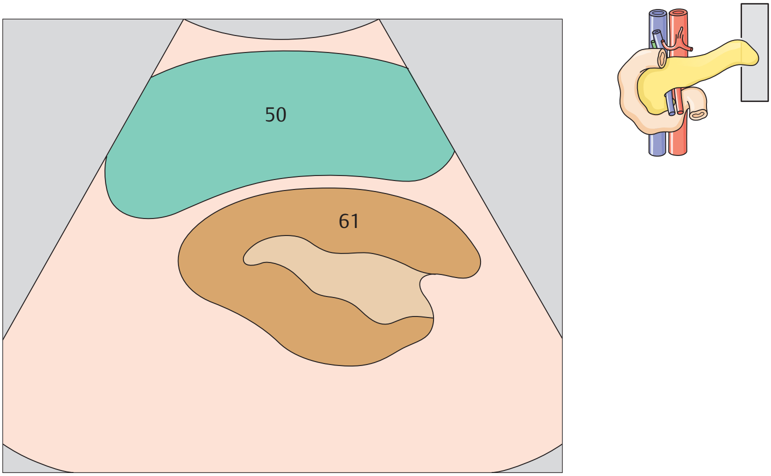


▶ **139** Scan posterior to tail of pancreas, spleen, kidney

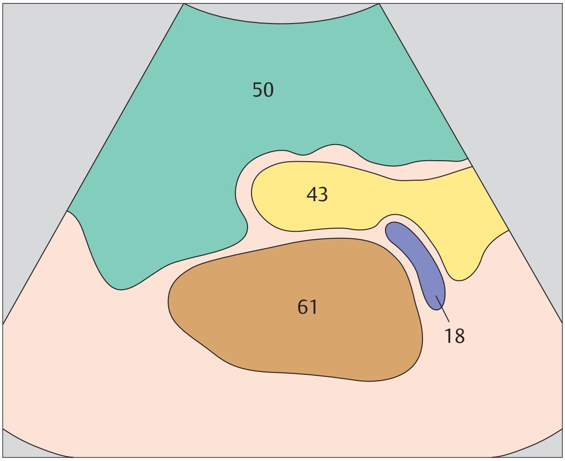




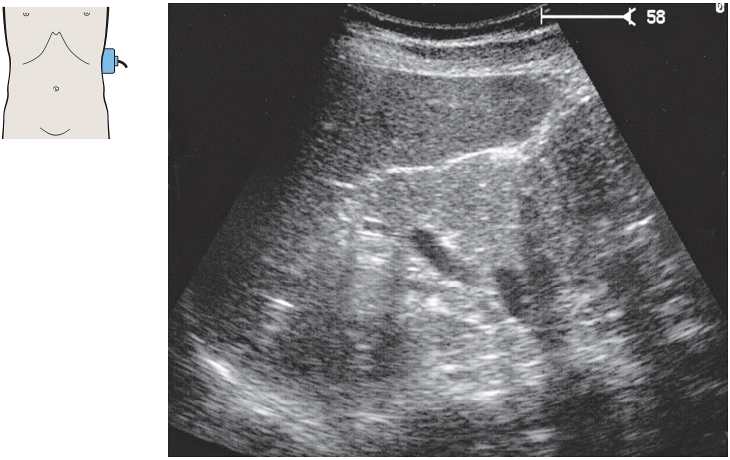
▶ **140** Spleen, tail of pancreas, kidney



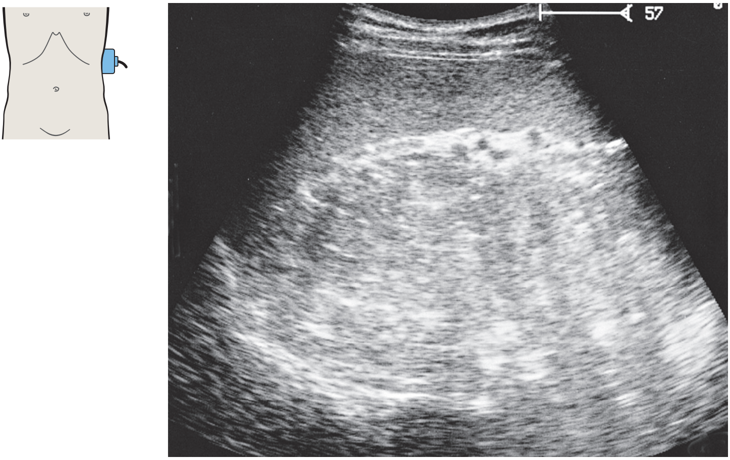
The tail of the pancreas is scanned intercostally through the spleen. Kidney and spleen serve as landmarks.



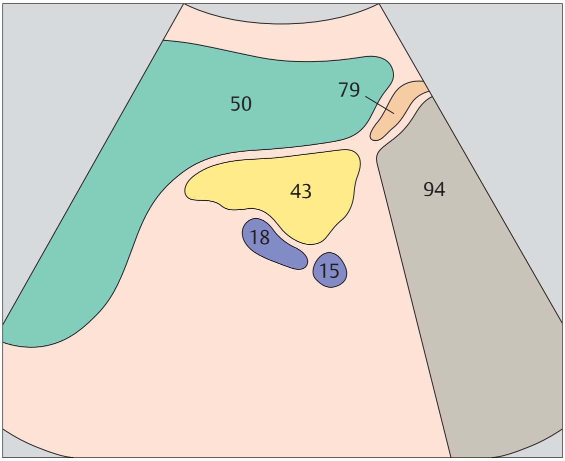
The tail of the pancreas is located in the splenic hilum between the spleen and the kidney.

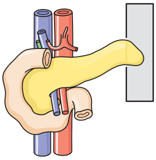


▶ **141** Spleen, tail of pancreas, kidney

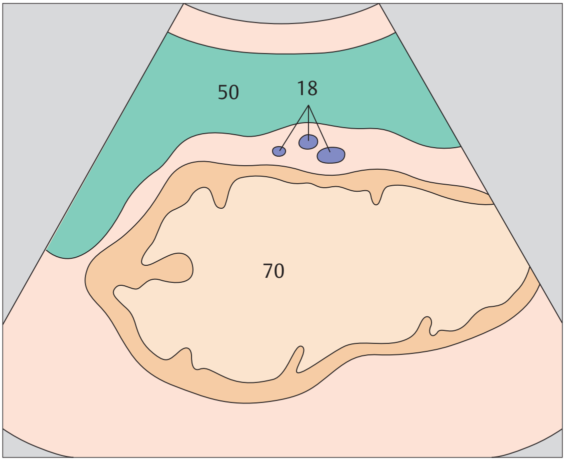


▶ **142** Scan anterior to tail of pancreas, spleen, stomach

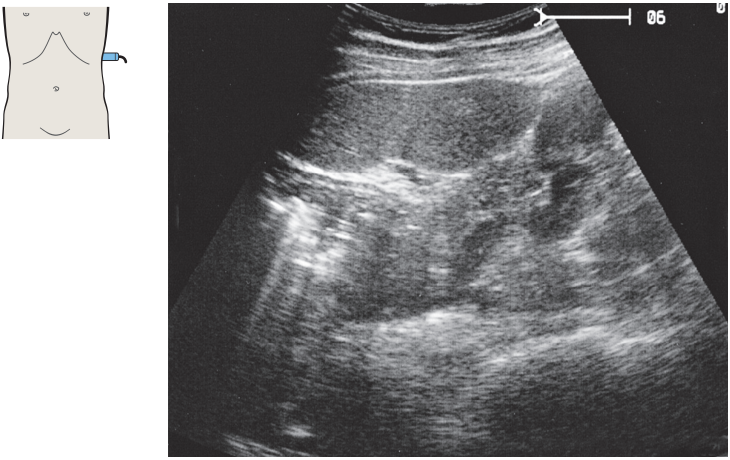




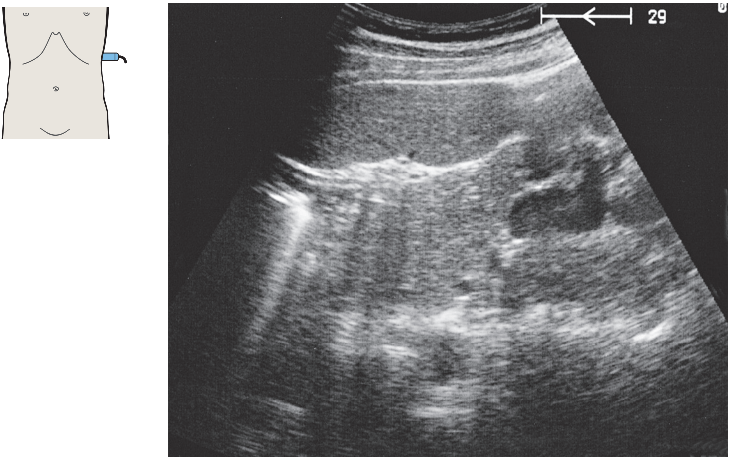
Interference from bowel gas is often encountered caudal to the tail of the pancreas.



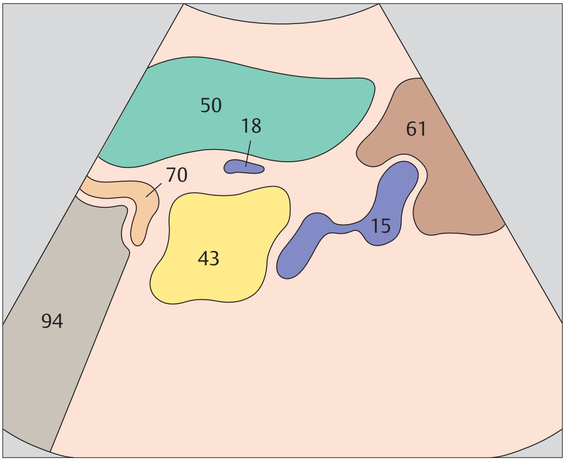
The stomach is a source of numerous artifacts anterior to the tail of the pancreas.

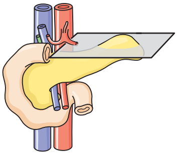


▶ **143** Spleen, tail of pancreas, kidney

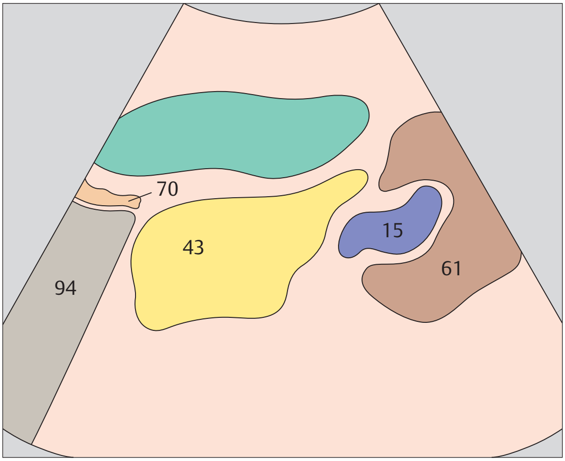


▶ **144** Spleen, tail of pancreas, kidney

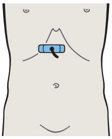

50
18
61
70
15
43
94

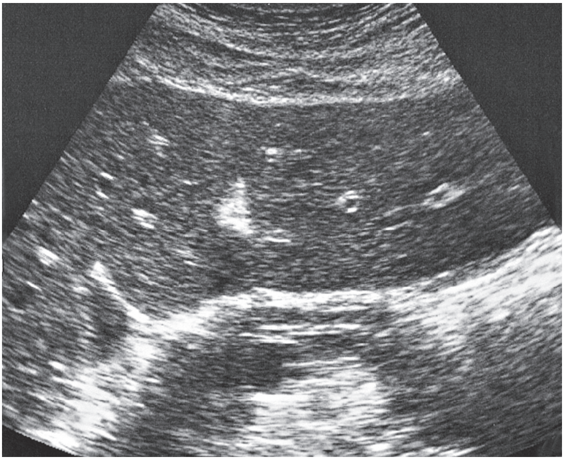


In transverse sections as well, the spleen is used as an acoustic window for scanning the tail of the pancreas. ◀

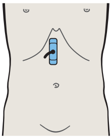

70
43
15
61
94

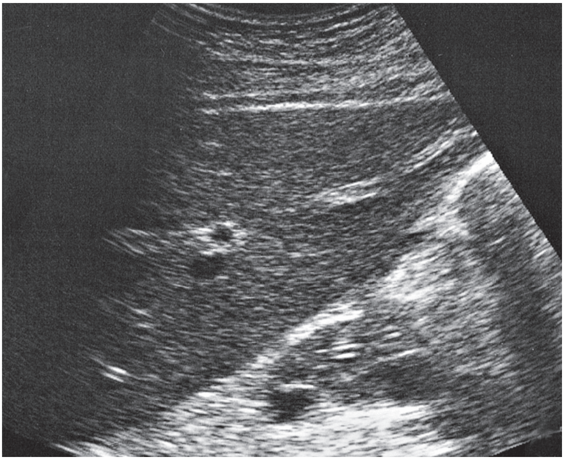
The tail of the pancreas lies in an angle between the spleen and the kidney. ◀



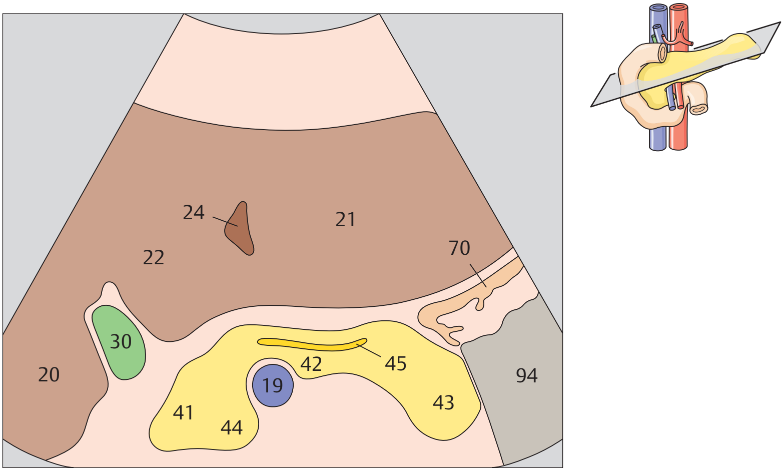


▶ **145** Transverse scan of pancreatic duct

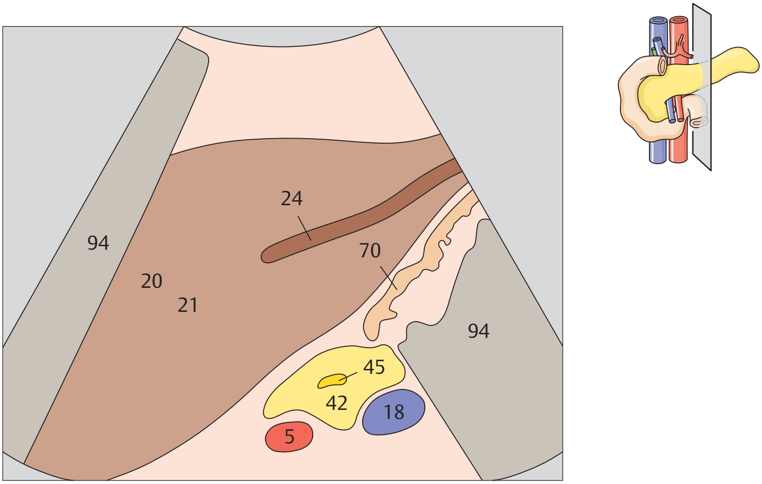




▶ **146** Longitudinal scan of pancreatic duct


24
21
22
70
30
20
42
45
19
94
43
41
44

The pancreatic duct has a variable course. It usually runs in the ventrocranial part of the parenchyma, appearing sonographically as two parallel echogenic lines.


24
94
70
20
21
94
45
42
18
5

In this plane the pancreatic duct appears as a fine, tubular structure with a luminal diameter up to 3 mm. It is located slightly anterior to the center of the gland.

5 Spleen

Longitudinal Flank Scans of the Spleen

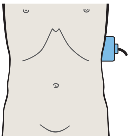
147 Spleen, kidney
148 Splenic hilum, splenic vein
149 Spleen, stomach
150 Spleen, stomach

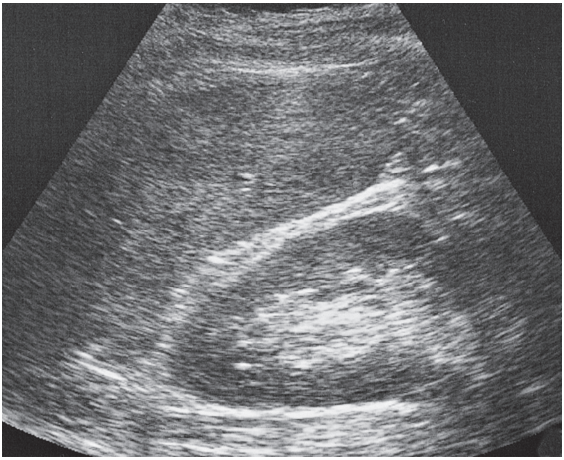
Transverse Flank Scans of the Spleen

151 Spleen, kidney, stomach
152 Spleen, kidney, pancreas
153 Spleen, stomach
154 Spleen, small bowel

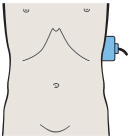
Details of the Spleen

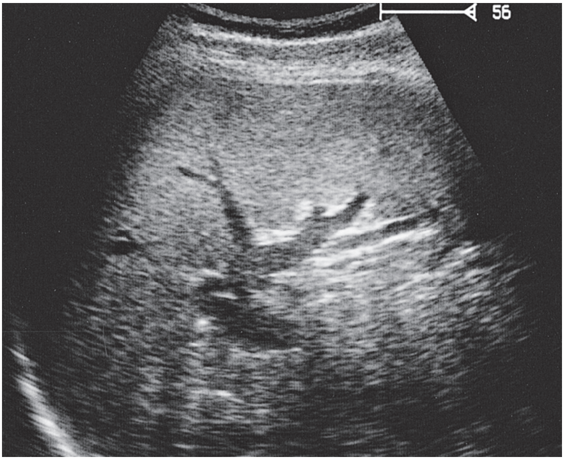
155 Accessory spleen
156 Accessory spleen



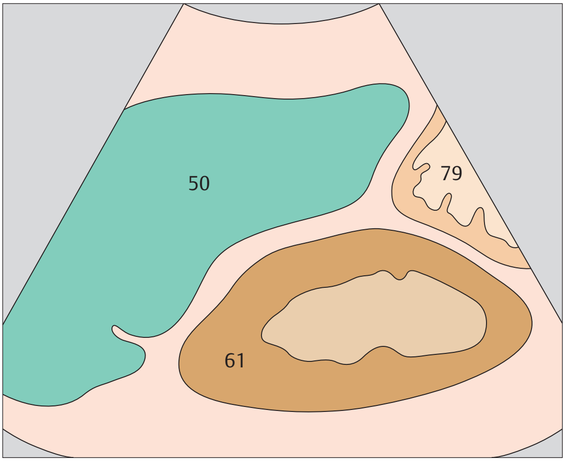


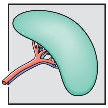
▶ **147** Spleen, kidney



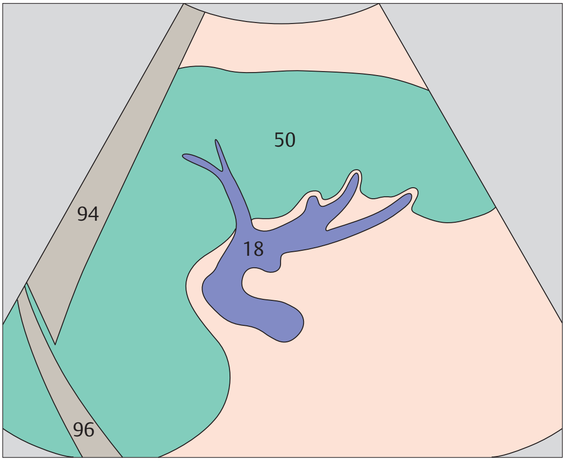


▶ **148** Splenic hilum, splenic vein

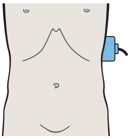


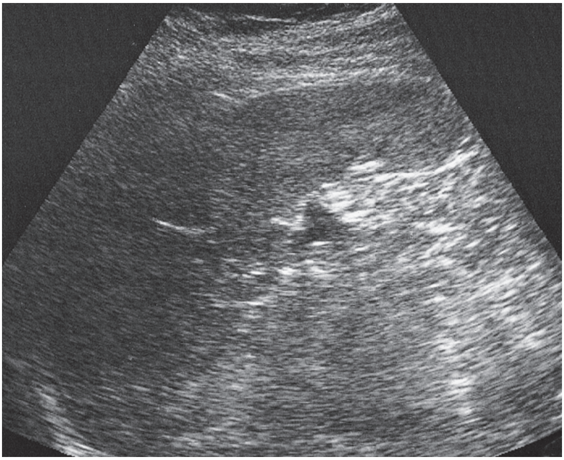


The spleen is identified in the longitudinal flank scan as a rounded triangle between the upper renal pole and the diaphragm. ◀

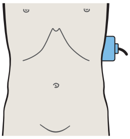


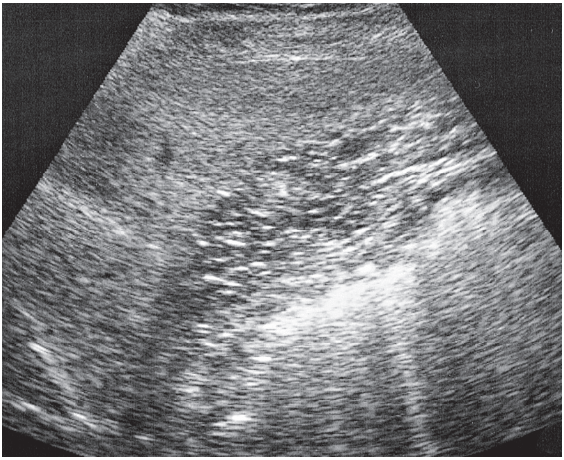
A flank scan at the level of the hilum displays the spleen in its greatest longitudinal dimension. ◀



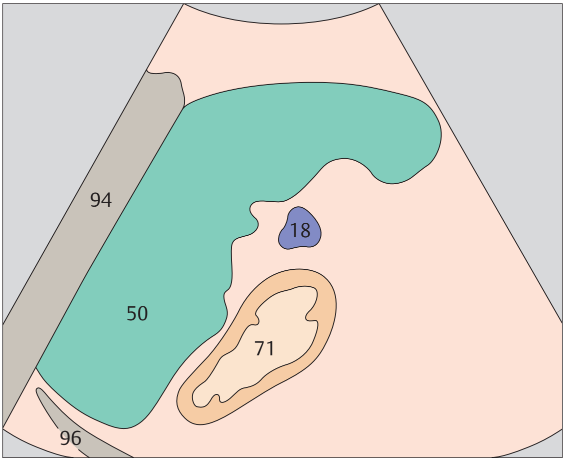


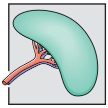
▶ **149** Spleen, stomach



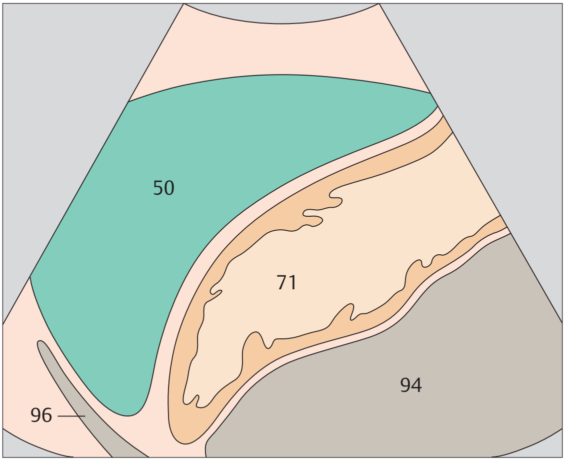


▶ **150** Spleen, stomach

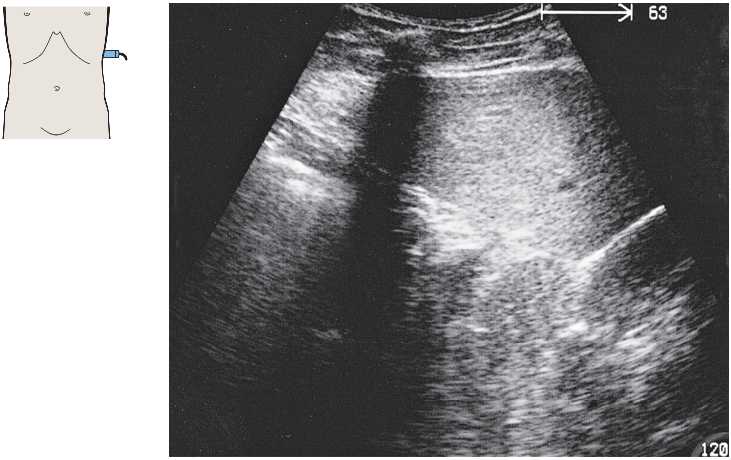

94
18
50
71
96



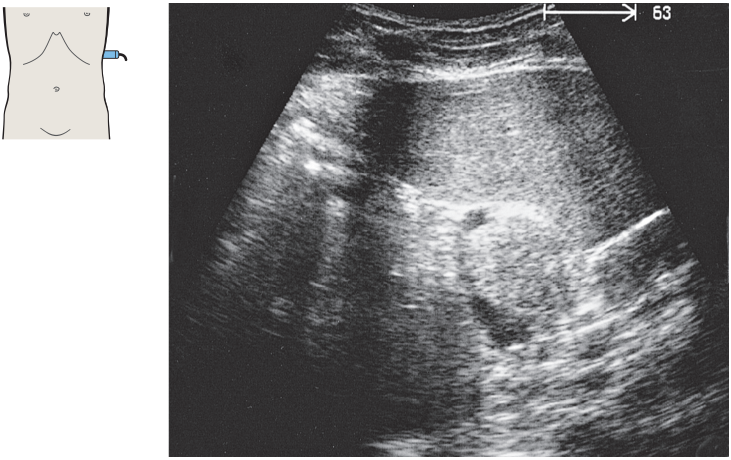
The spleen lies against the stomach anteriorly and medially.



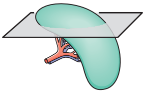
The spleen exhibits a typical crescent shape in an anterior flank scan.

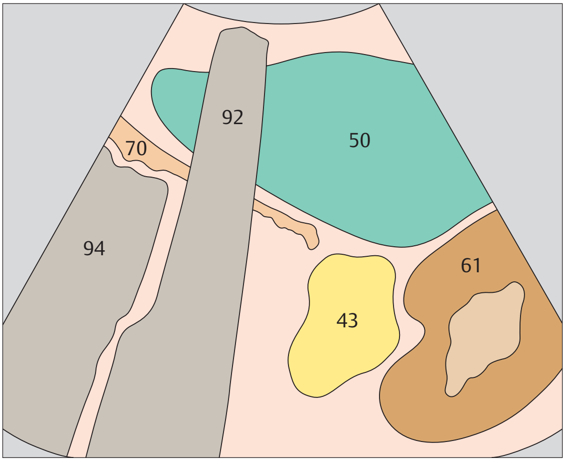


▶ **151** Spleen, kidney, pancreas, stomach

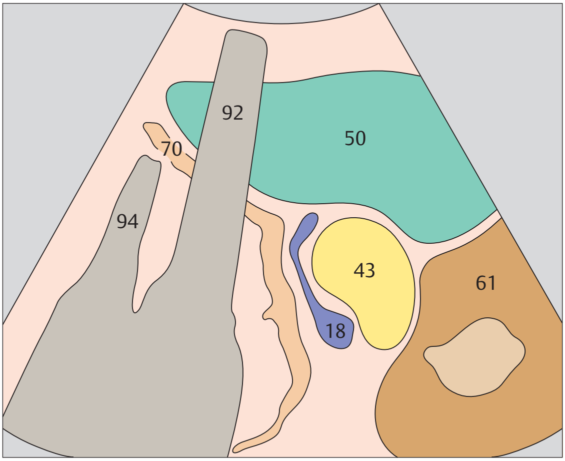


▶ **152** Spleen, kidney, pancreas

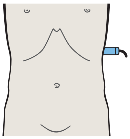


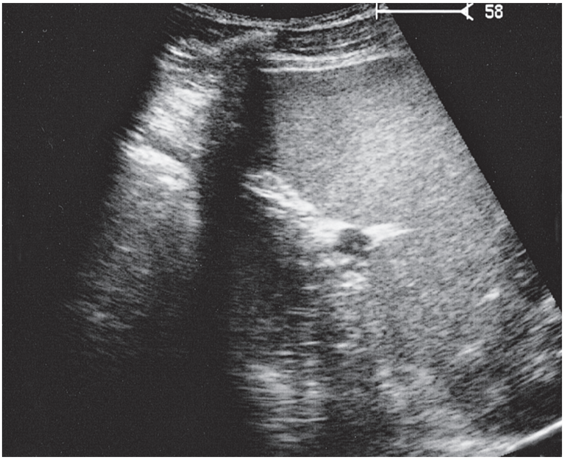

92
70
50
94
61
43

A high transverse flank scan demonstrates the typical triad of the spleen, kidney, and stomach.

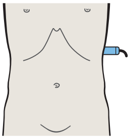

92
50
70
94
43
61
18

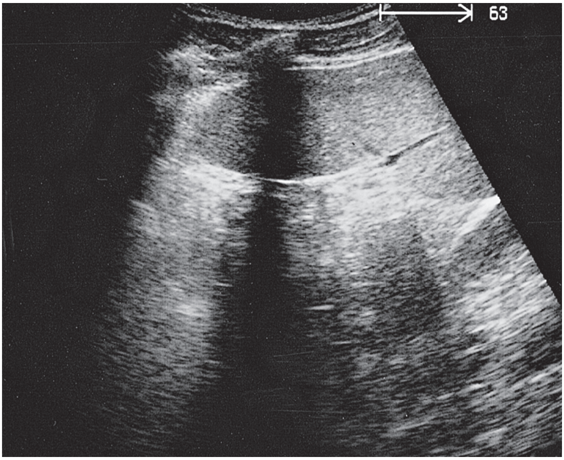
The tail of the pancreas can usually be identified in the splenic hilum next to the splenic vessels.



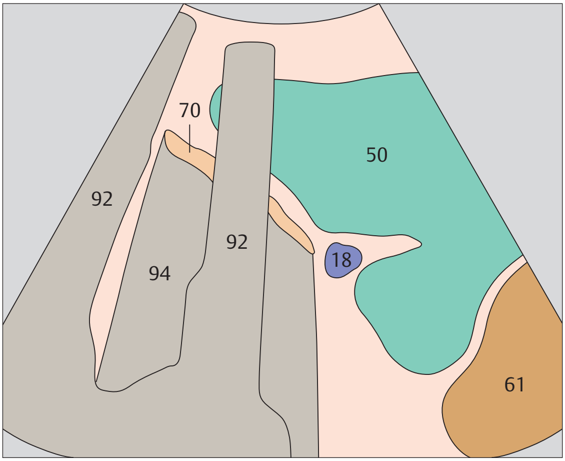


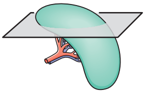
▶ **153** Spleen, stomach



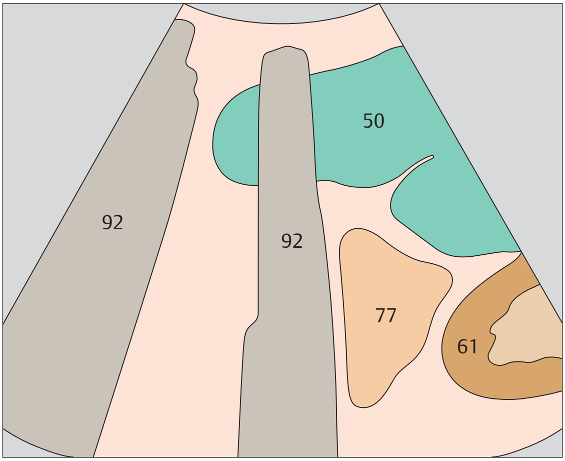


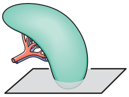
▶ **154** Spleen, small bowel


70
50
92
92
94
18
61

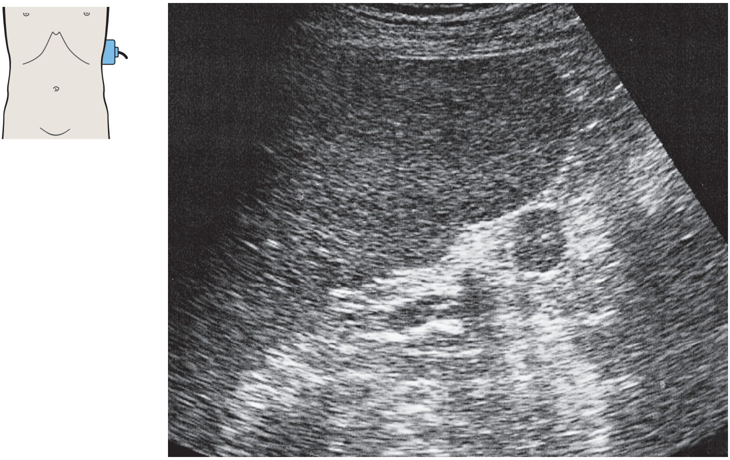


The spleen may be deeply lobulated by septa.

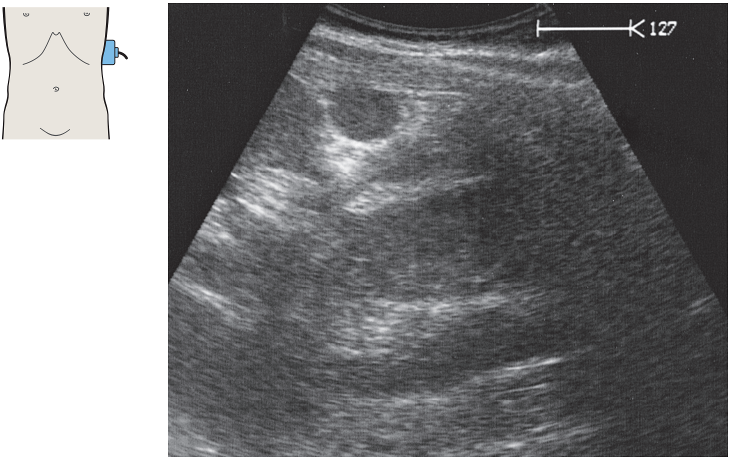

50
92
92
77
61



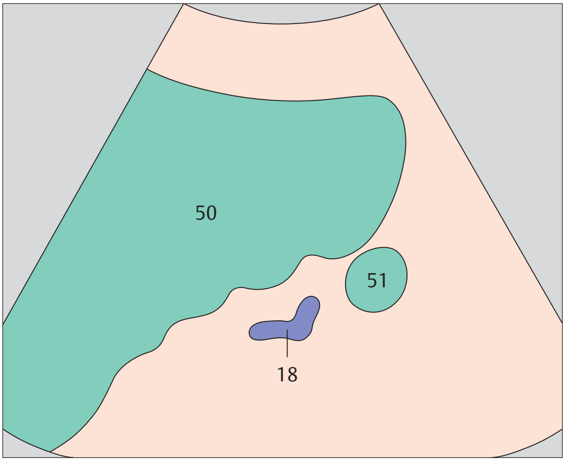
Loops of small bowel are located medial to the lower pole of the spleen.

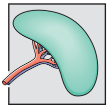


▶ **155** Accessory spleen

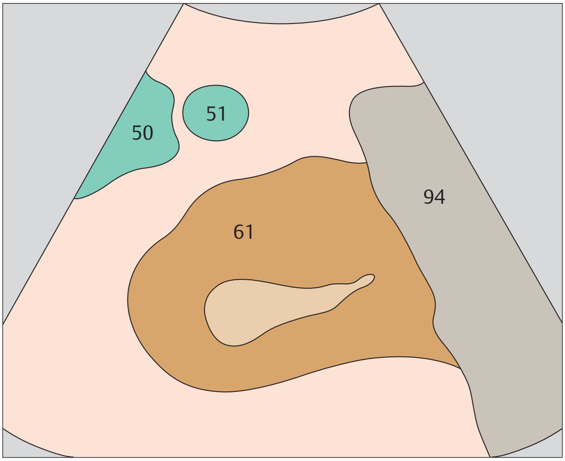


▶ **156** Accessory spleen





Accessory spleens are most commonly found in the hilar region. ◀



An accessory spleen is occasionally found at the lower pole. ◀

6 Kidneys

Longitudinal Flank Scans of the Right Kidney from Posterior to Anterior

157	Kidney, liver
158	Kidney, liver, colic flexure
159	Kidney, renal vein, liver
160	Kidney, renal vein, liver

Transverse Flank Scans of the Right Kidney from Above Downward

161	Kidney, liver, psoas muscle, quadratus lumborum muscle
162	Kidney, liver, psoas muscle, quadratus lumborum muscle

Upper Abdominal Longitudinal Scans of the Right Kidney from Right to Left

163	Kidney, liver
164	Kidney, liver, colic flexure
165	Kidney, renal vein, colon
166	Kidney, renal vein, colon

Upper Abdominal Transverse Scans of the Right Kidney from Above Downward

167 Kidney, renal vein, vena cava, liver
168 Kidney, renal vein, renal artery, vena cava, liver

Longitudinal Flank Scans of the Left Kidney from Posterior to Anterior

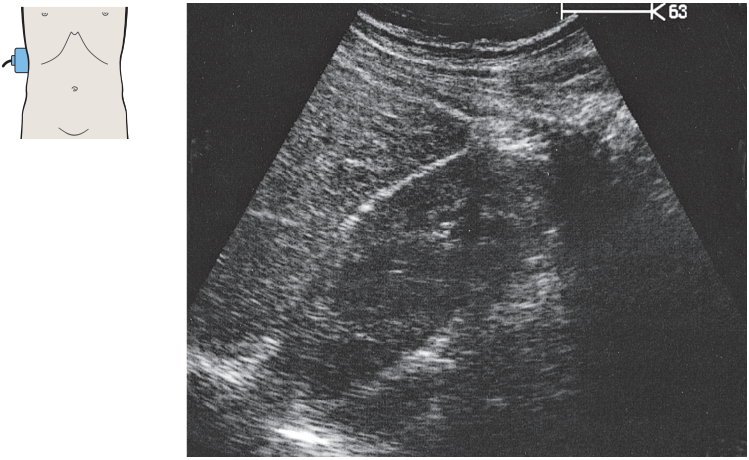
169 Kidney, spleen, psoas muscle
170 Kidney, spleen, psoas muscle
171 Kidney, spleen, psoas muscle
172 Kidney, renal vein, spleen, aorta

Transverse Flank Scans of the Left Kidney from Above Downward

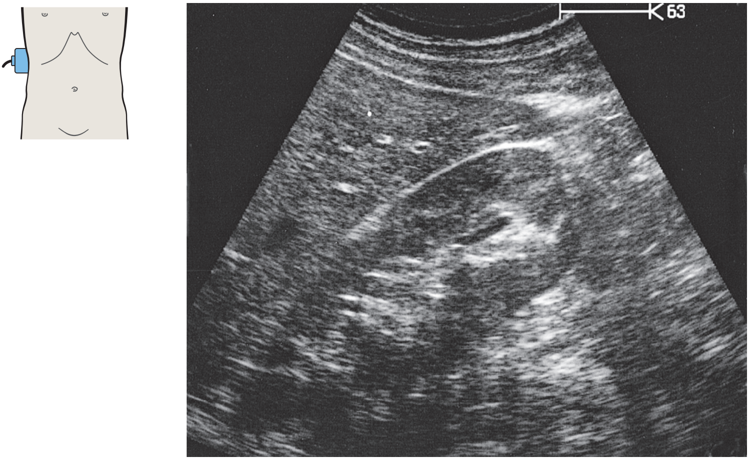
173 Kidney, spleen, bowel
174 Kidney, spleen, psoas muscle

Details of the Kidneys

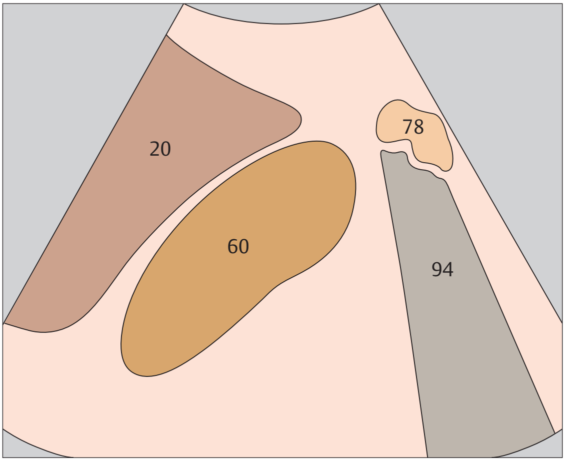
175 Medullary pyramids
176 Collecting system

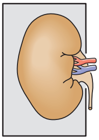


▶ **157** Kidney, liver

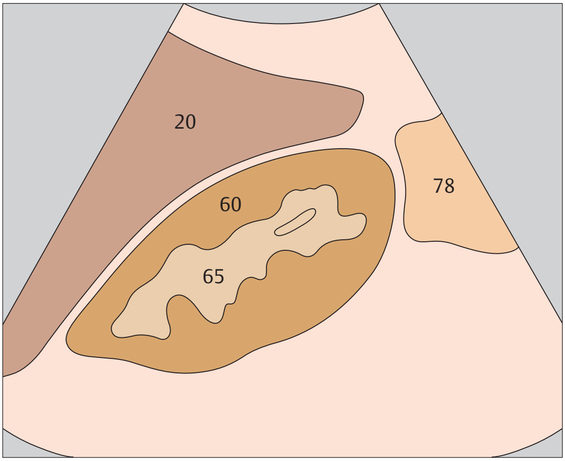


▶ **158** Kidney, liver, colic flexure

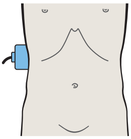


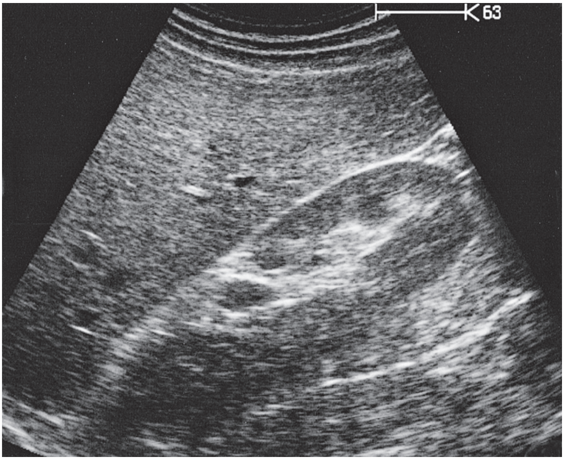


The liver serves as an acoustic window for scanning the right kidney.

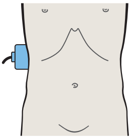


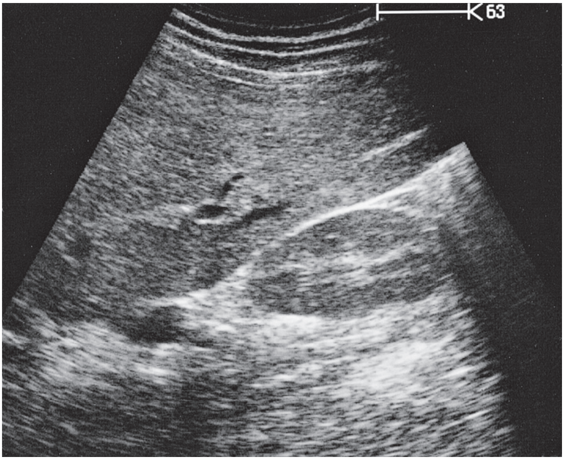
The central echo complex of the kidney is a summation effect produced by the pyelocaliceal system, blood vessels, lymphatics, fatty tissue, and the renal sinus.



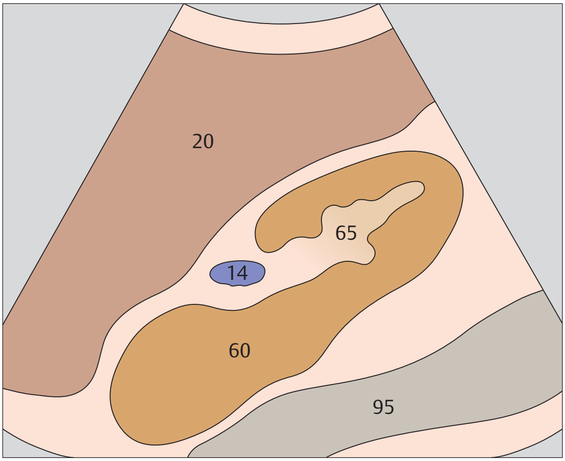


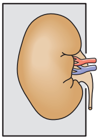
► **159** Kidney, renal vein, liver



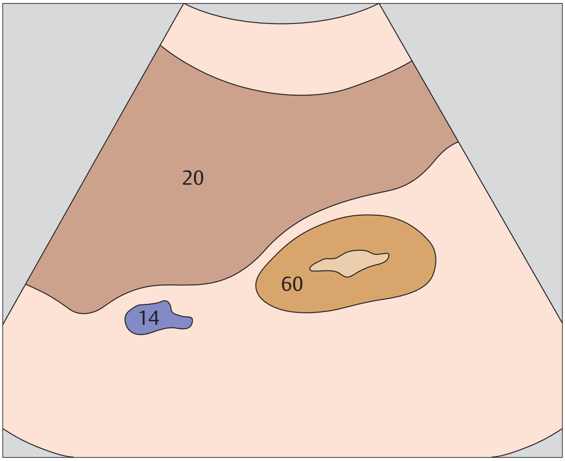


► **160** Kidney, renal vein, liver

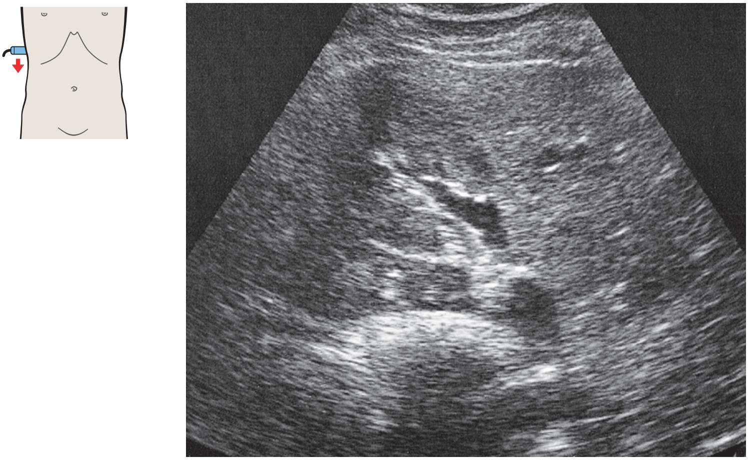




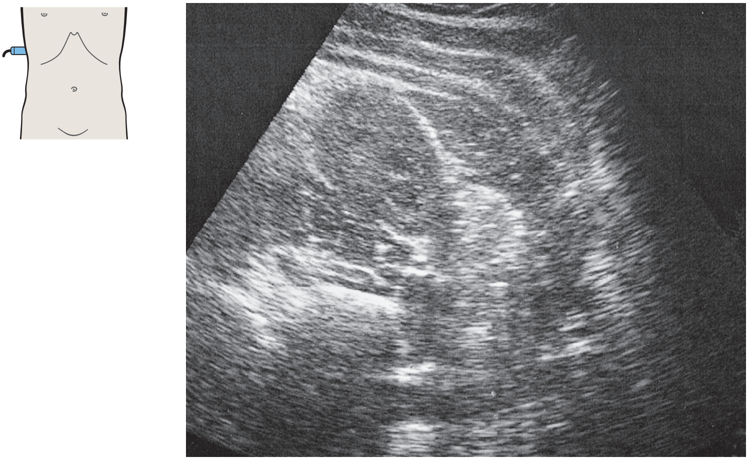
During respiratory excursions, the kidneys glide downward on the lumbar muscles. ◀



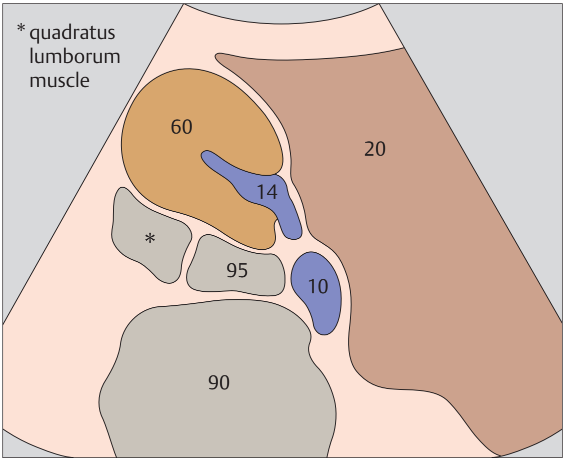
The fibrous renal capsule cannot be visualized with ultrasound. ◀

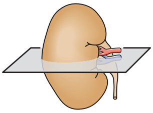


▶ **161** Kidney, liver, psoas muscle, quadratus lumborum muscle

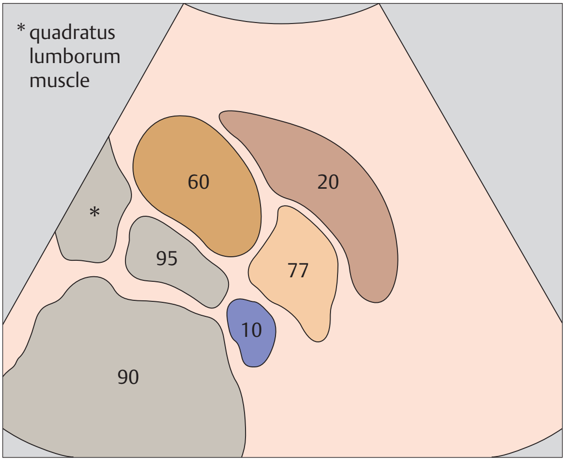


▶ **162** Kidney, liver, psoas muscle, quadratus lumborum muscle

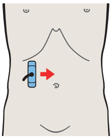

* quadratus lumborum muscle
60
20
14
*
95
10
90

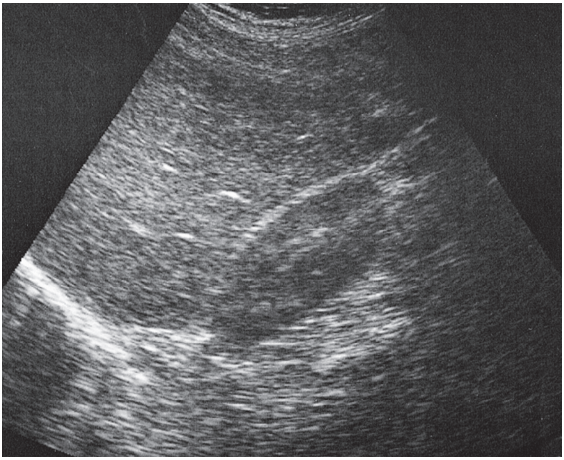


The posterior aspect of the right kidney lies in an angle between the spinal column, musculature, and right lobe of the liver.

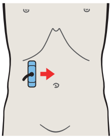

* quadratus lumborum muscle
60
20
*
95
77
10
90

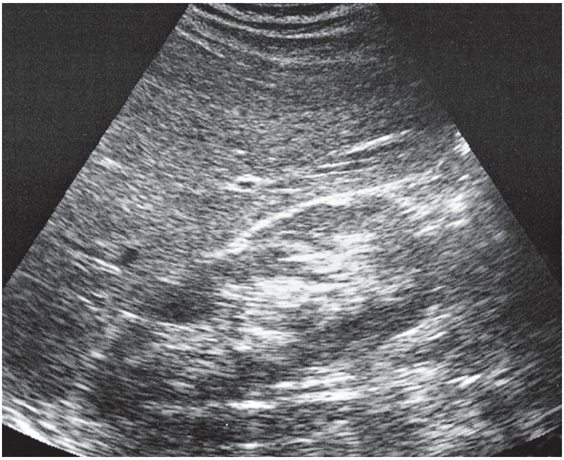
The kidney is located anterior to the quadratus lumborum muscle and lateral to the psoas major muscle.



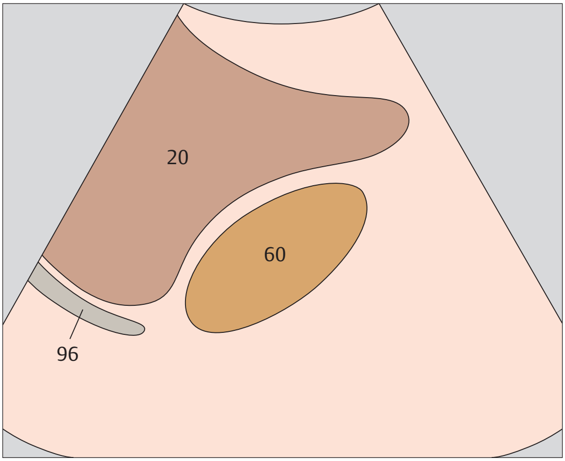


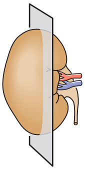
▶ **163** Kidney, liver



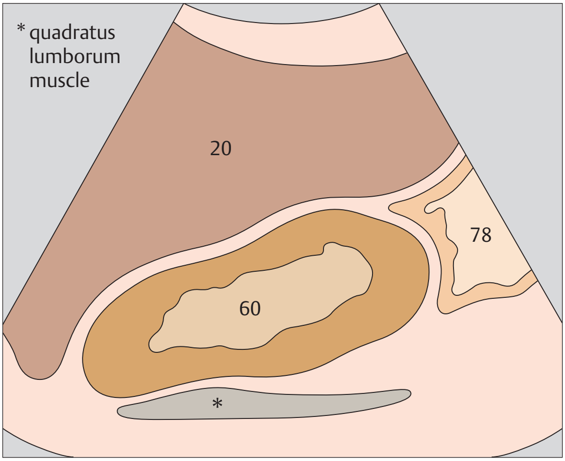


▶ **164** Kidney, liver, colic flexure

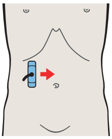


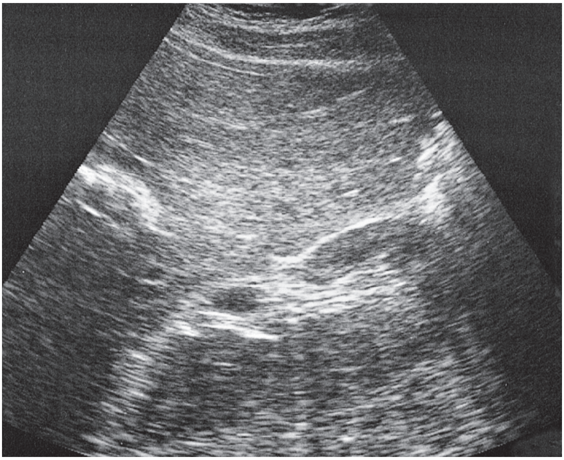


Unlike the left kidney, the right kidney is readily scanned from the anterior aspect by using the liver as an acoustic window. ◀

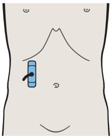

* quadratus lumborum muscle
20
60
78
*

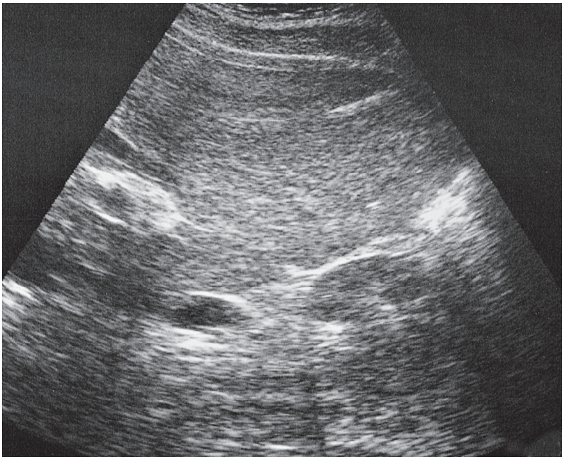
The right lobe of the liver covers the kidney anteriorly. The right colic flexure and duodenum also overlie the kidney, especially its caudal half. ◀



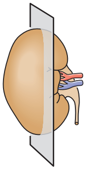


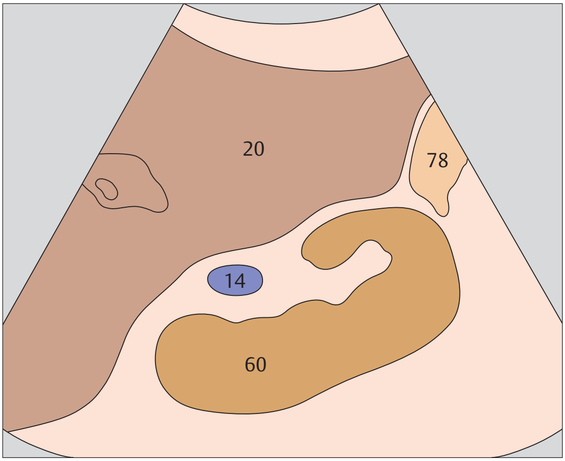
▶ **165** Kidney, renal vein, colon



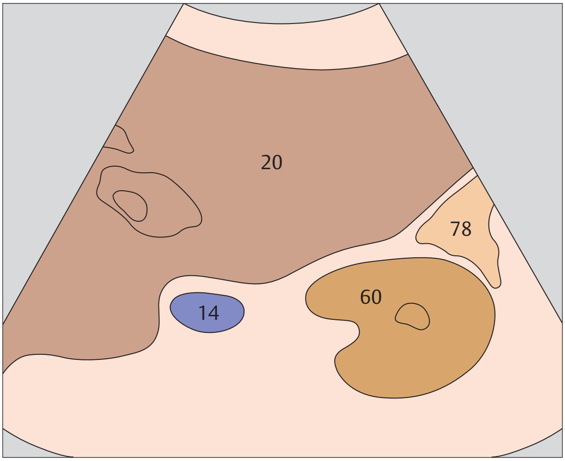


▶ **166** Kidney, renal vein, colon

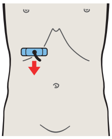


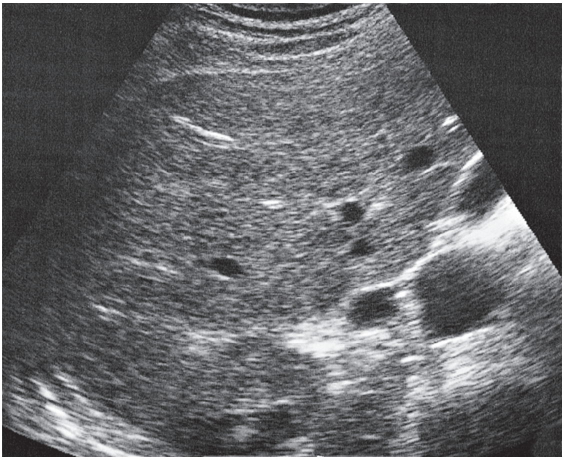


The colon overlies the lower pole of the right kidney. ◄

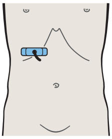


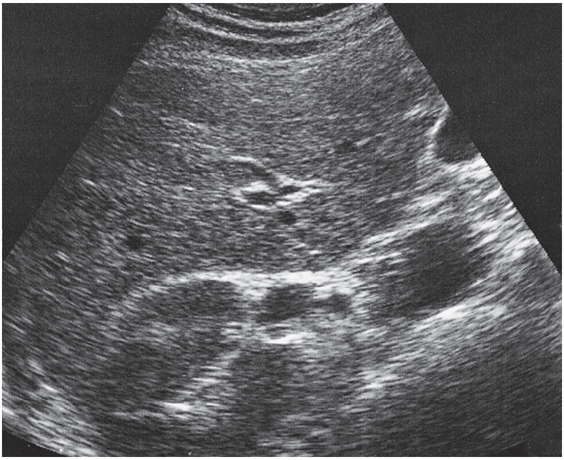
The renal vein runs obliquely upward from the hilum to the vena cava. ◄



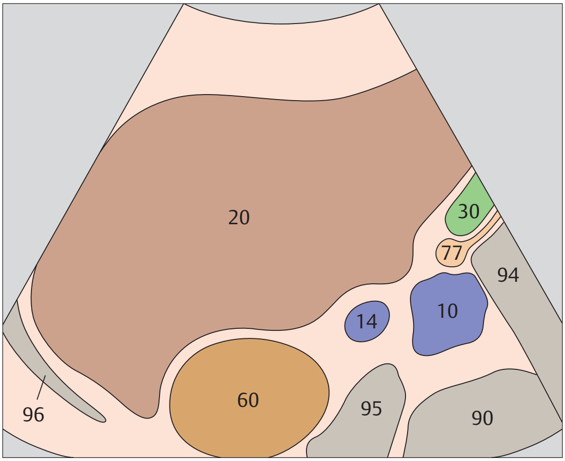


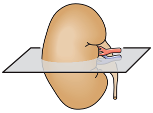
▶ **167** Kidney, renal vein, vena cava, liver



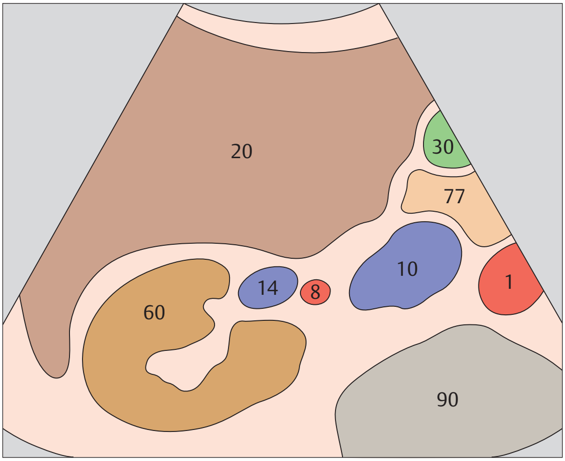


▶ **168** Kidney, renal vein, renal artery, vena cava, liver

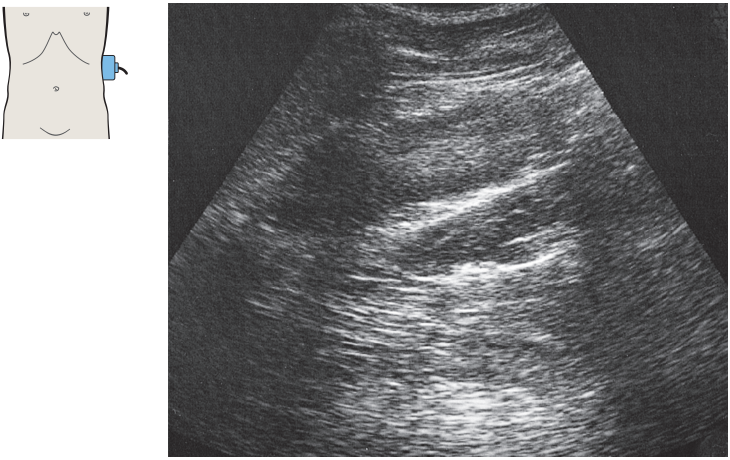

20
30
77
94
10
14
60
95
90
96



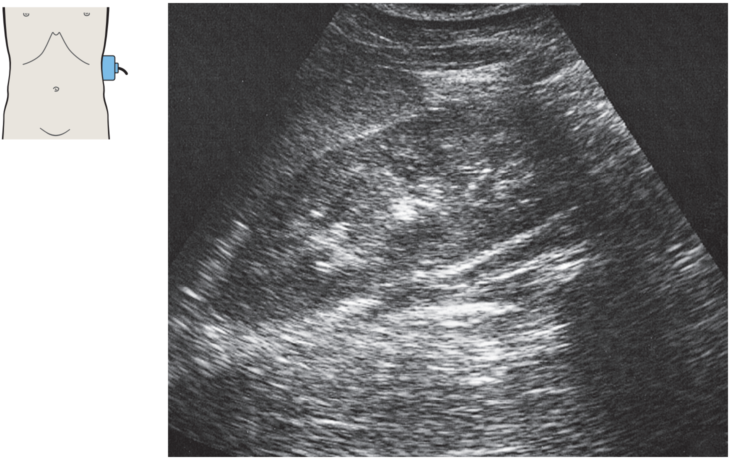
The renal vein opens into the vena cava at the level of the upper renal pole.


20
30
77
10
1
14
8
60
90

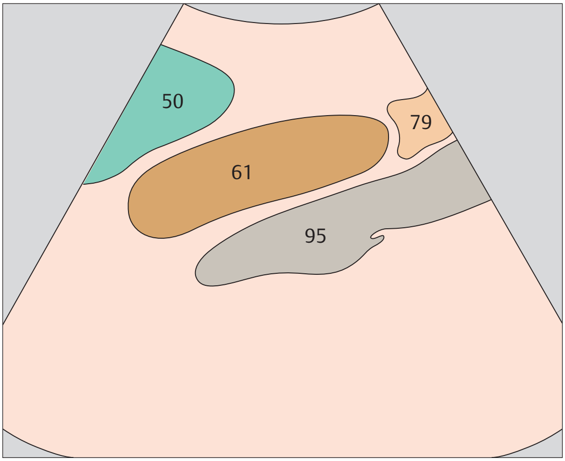
The renal artery arises from the aorta and enters the renal hilum. At that location it is dorsocaudal to the renal vein, which usually is considerably larger than the artery.

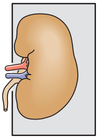


▶ **169** Kidney, spleen, psoas muscle

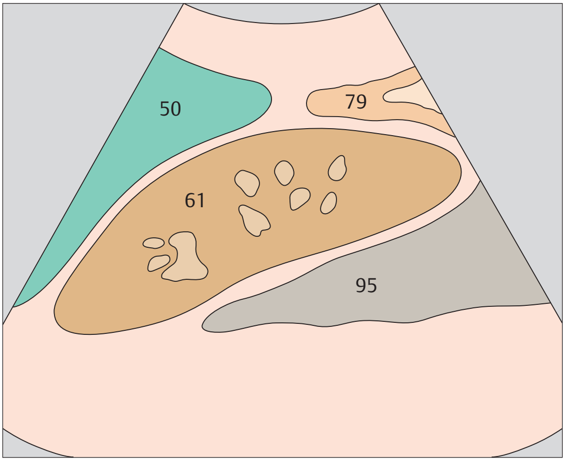


▶ **170** Kidney, spleen, psoas muscle

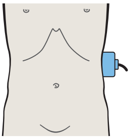


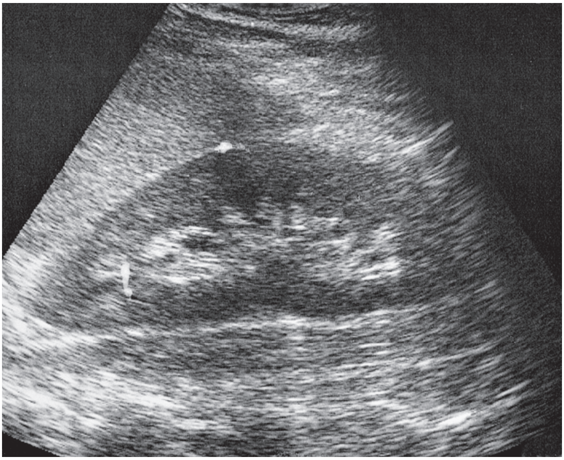


There is no good acoustic window available for scanning the left kidney. ◀

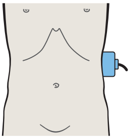


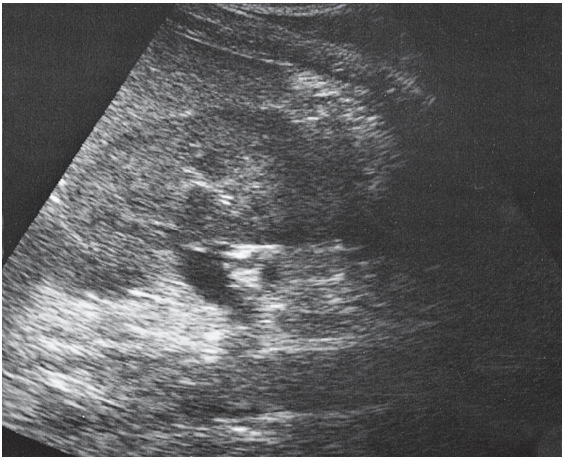
The spleen extends laterally to about the middle of the kidney. ◀



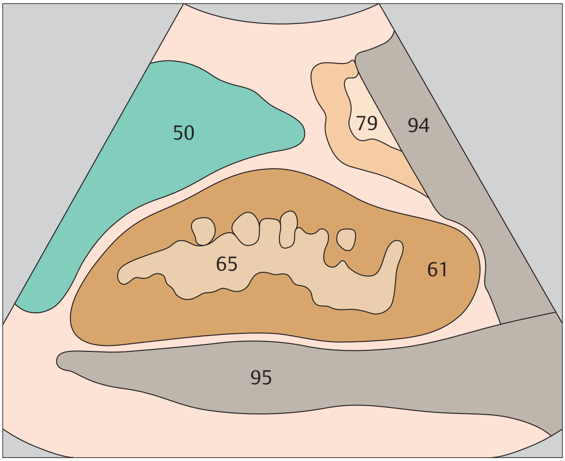


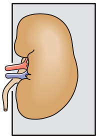
▶ **171** Kidney, spleen, psoas muscle



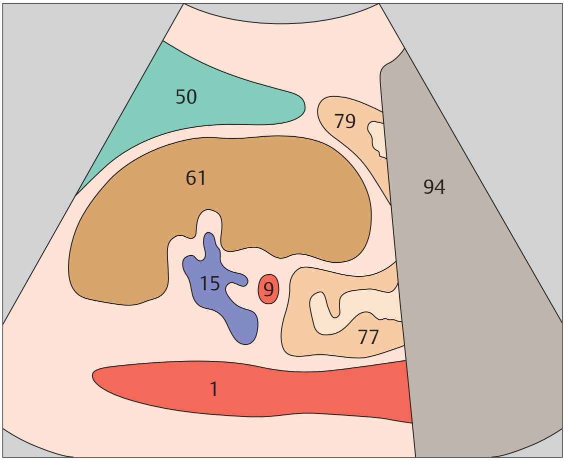


▶ **172** Kidney, renal vein, spleen, aorta

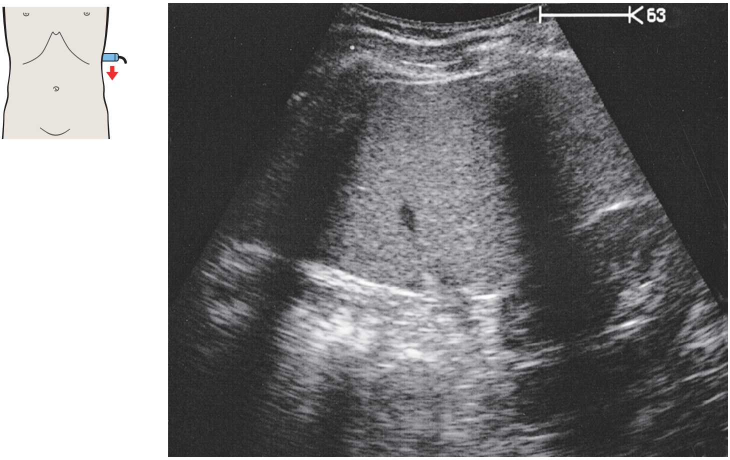

50
79
94
65
61
95



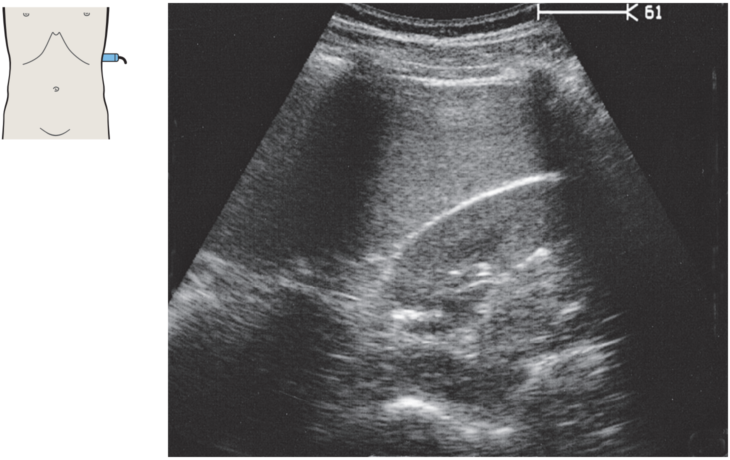
The lower half of the left kidney is covered laterally by the descending colon and left colic flexure.


50
79
61
94
15
9
77
1

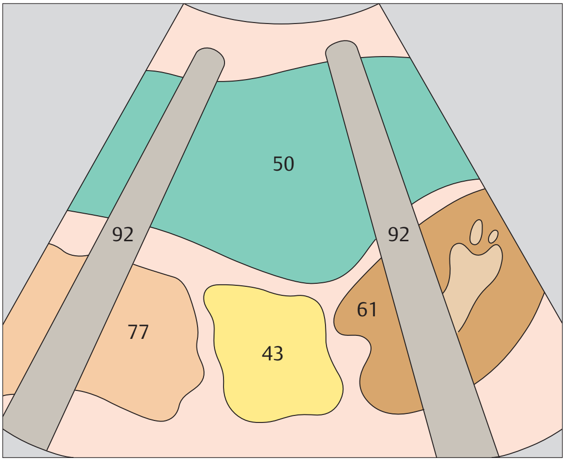
In the left longitudinal flank scan, the aorta is seen in the lower part of the image.

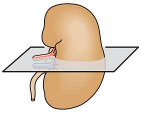


▶ **173** Kidney, spleen, bowel

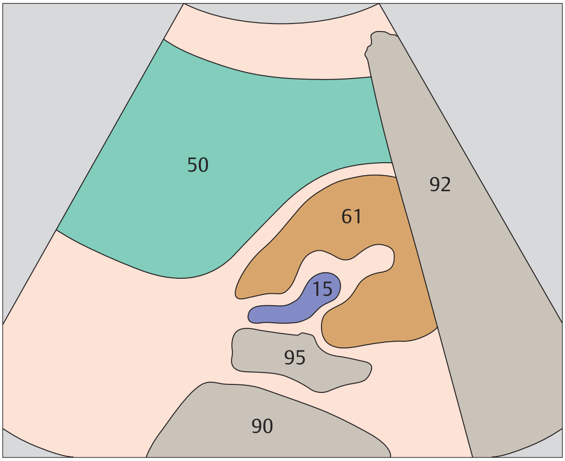


▶ **174** Kidney, spleen, psoas muscle

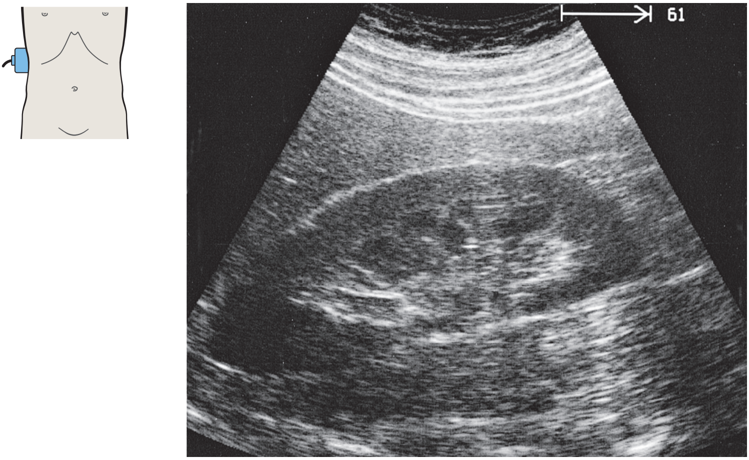

50
92
92
61
77
43



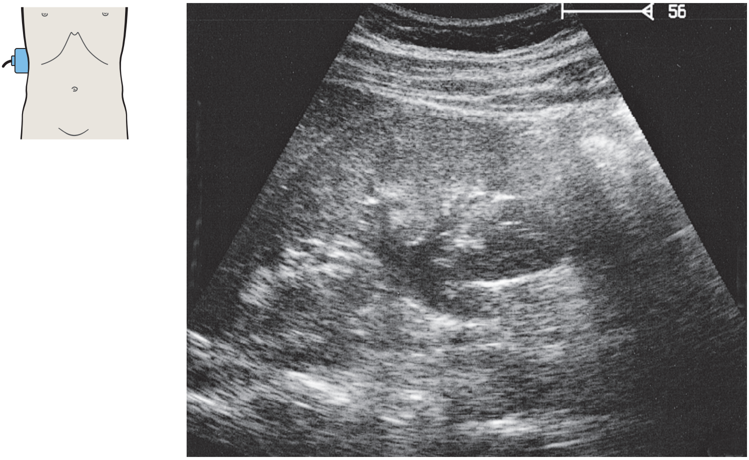
The ribs pose a barrier to transsplenic scanning of the left kidney. ◀


50
92
61
15
95
90

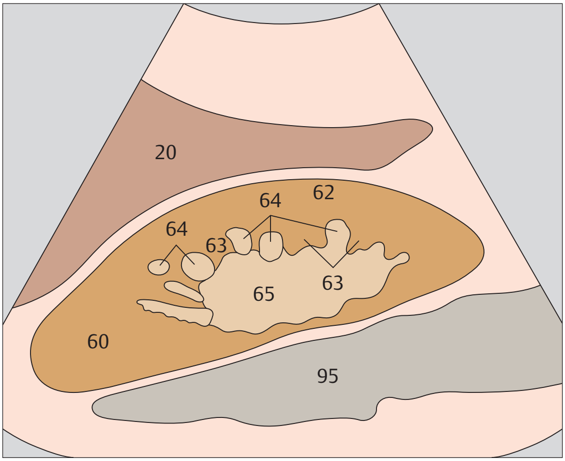
The posterior aspect of the left kidney lies in an angle between the spinal column, musculature, and spleen. ◀

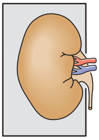


▶ **175** Medullary pyramids

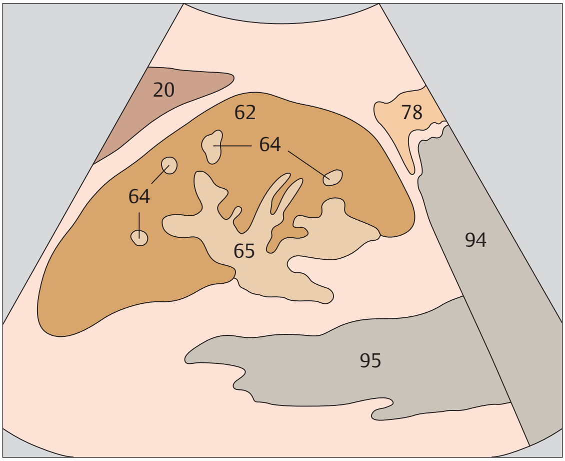


▶ **176** Collecting system


20
64
62
64
63
65
63
60
95



An imaginary line joining the bases of the hypoechoic medullary pyramids in the ultrasound image marks the boundary line between the renal cortex and medulla. ◀


20
62
78
64
64
94
65
64
95

Strong diuresis produces a band-like or stellate fluid-filling pattern in the renal pelvis. ◀

7 Adrenal Glands

Upper Abdominal Longitudinal Scans of the Right Adrenal Gland from Right to Left

177 Kidney, liver
178 Kidney, liver
179 Adrenal gland, liver
180 Adrenal gland, vena cava, renal artery

Upper Abdominal Transverse Scans of the Right Adrenal Gland from Below Upward

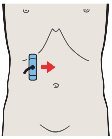
181 Kidney, vena cava
182 Kidney, renal vein, vena cava
183 Renal vein, vena cava
184 Adrenal gland, vena cava

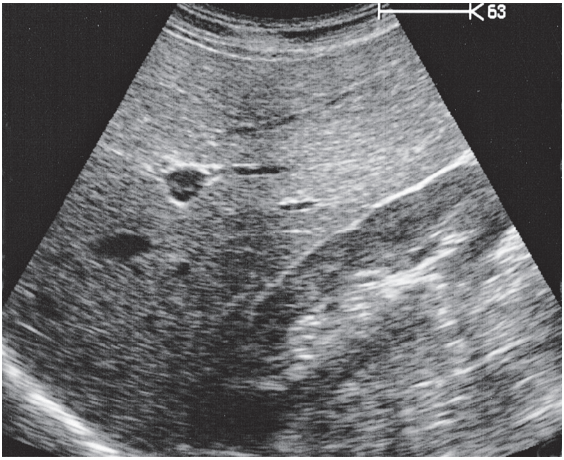
Longitudinal Flank Scans of the Left Adrenal Gland from Back to Front

185 Kidney, spleen
186 Adrenal gland, kidney, spleen
187 Adrenal gland, kidney, spleen
188 Spleen, tail of pancreas

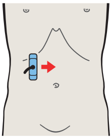
Details of the Adrenal Glands

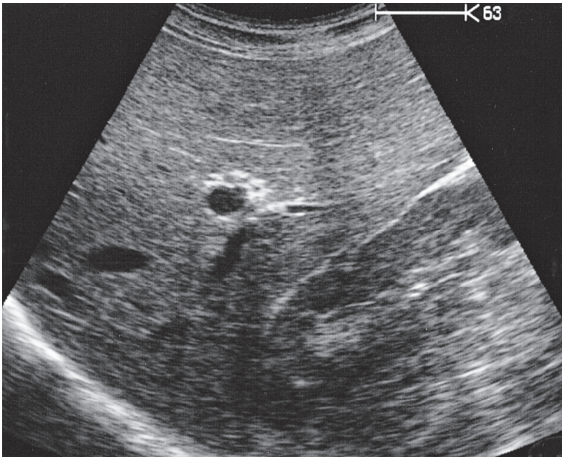
189 Layers of adrenal gland
190 Layers of adrenal gland



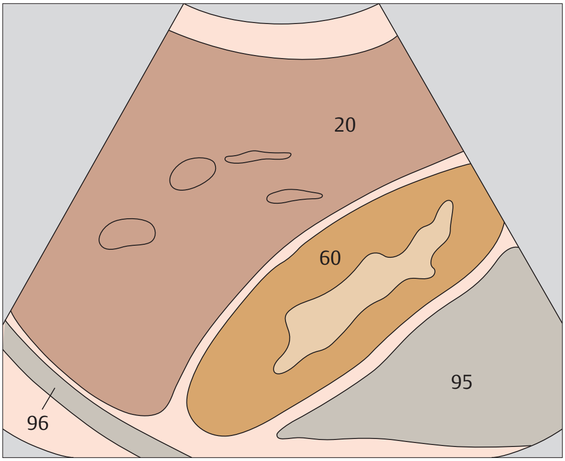


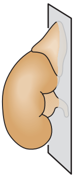
▶ **177** Kidney, liver



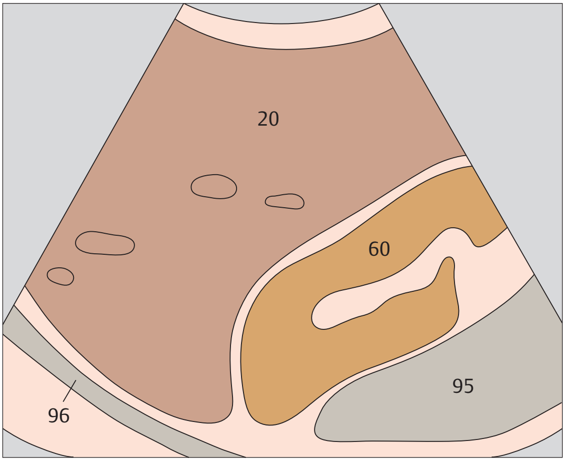


▶ **178** Kidney, liver

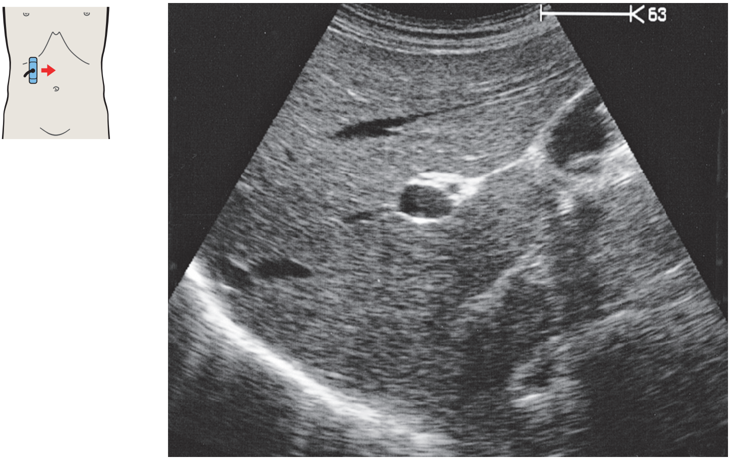




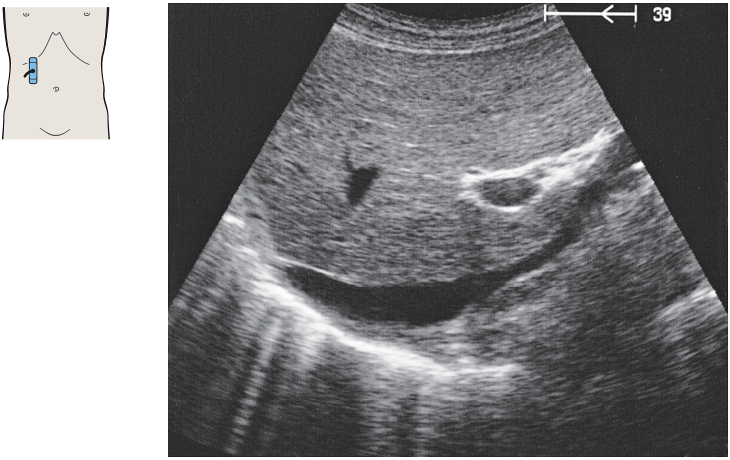
The right adrenal gland is located at the level of the upper renal pole, medial and anterior to the right kidney. ◄



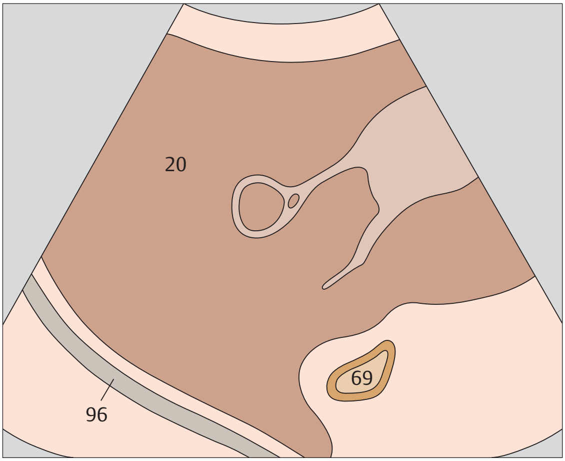
In an upper abdominal longitudinal scan from the anterior aspect, the kidney is used as a landmark for locating the right adrenal gland. ◄

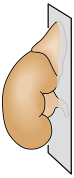


▶ **179** Adrenal gland, liver

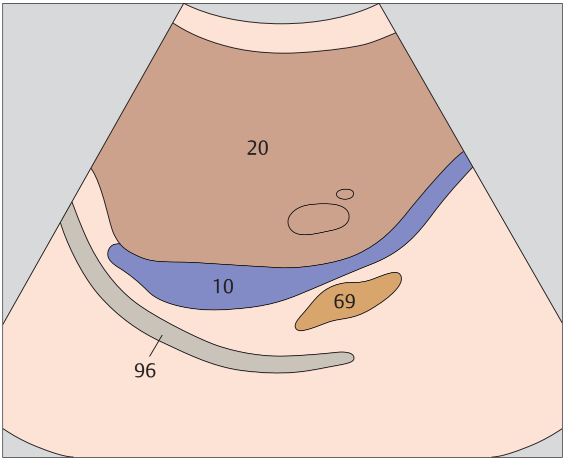


▶ **180** Adrenal gland, vena cava, renal artery

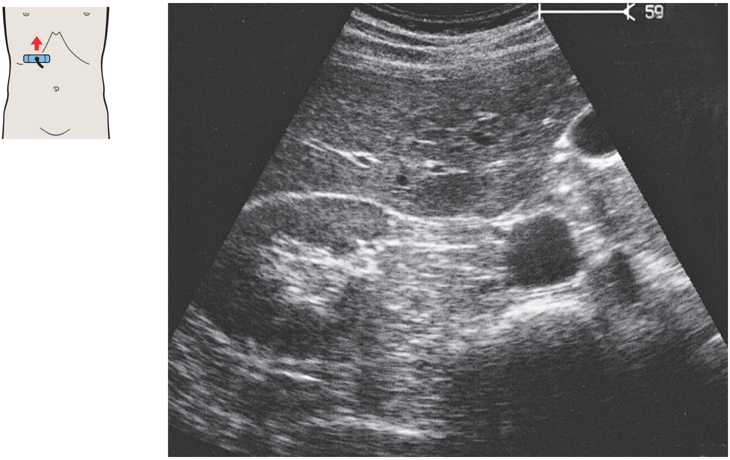




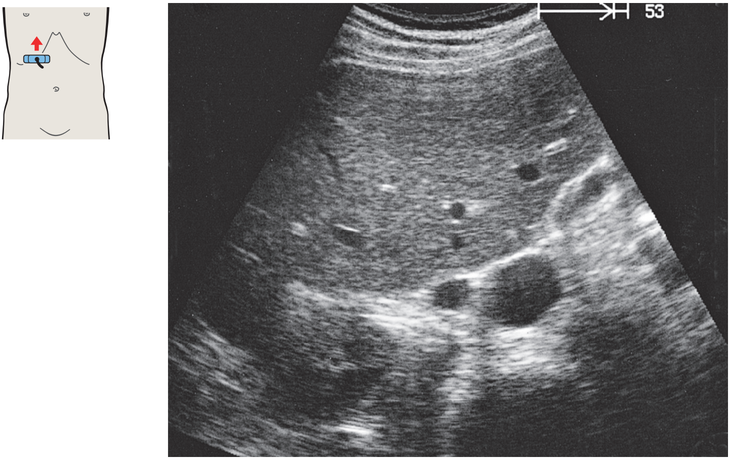
In a scan across the kidney from right to left, when the upper renal pole is just disappearing from the image the region of the right adrenal gland has been located.



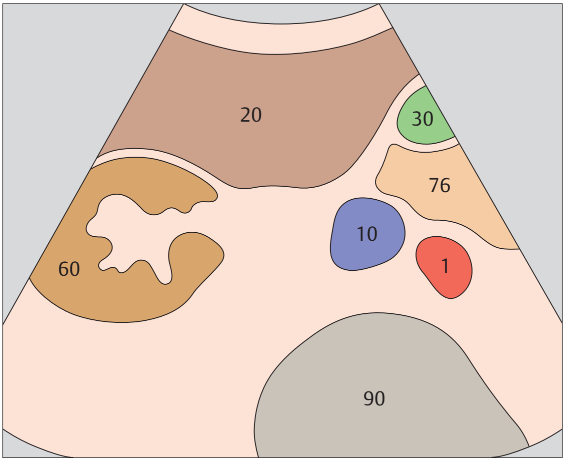
The right adrenal gland extends behind the vena cava, above the renal vessels.

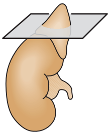


▶ **181** Kidney, vena cava

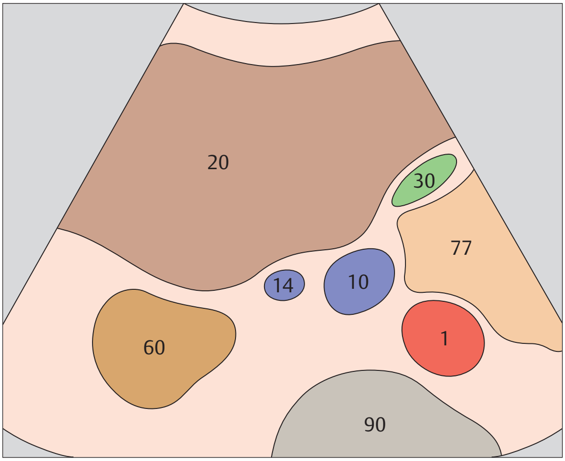


▶ **182** Kidney, renal vein, vena cava

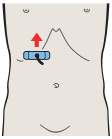

20
30
76
10
1
60
90

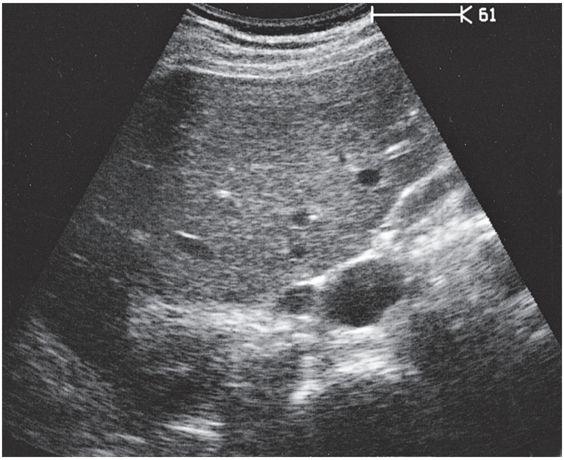


The landmarks for identifying the right adrenal gland region in transverse section are the kidney, the inferior surface of the liver, and the vena cava.

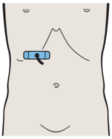

20
30
77
14
10
1
60
90

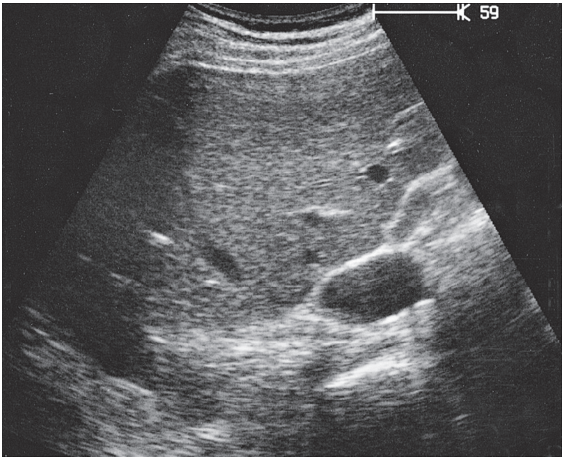
The adrenal region is located above the renal hilar vessels.



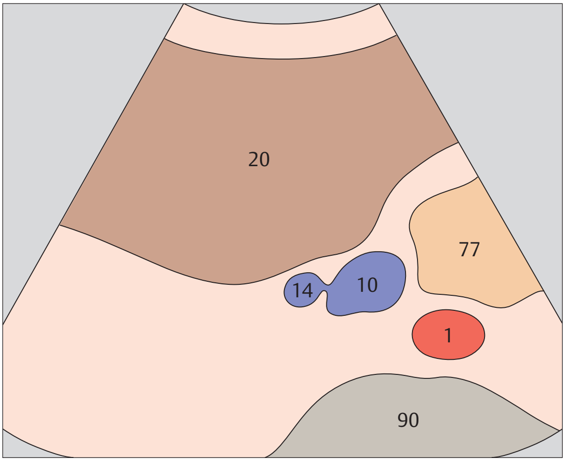


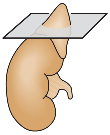
▶ **183** Renal vein, vena cava





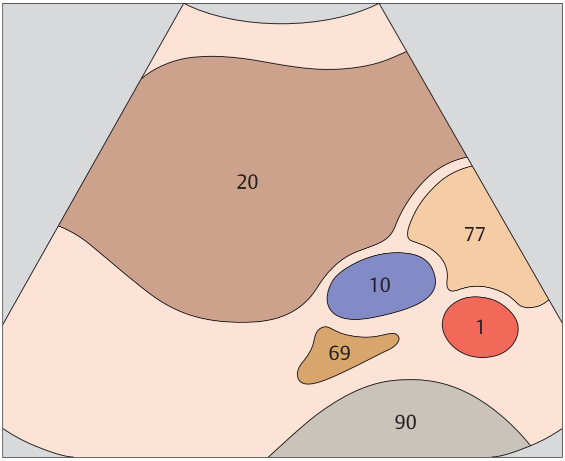
▶ **184** Adrenal gland, vena cava





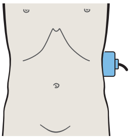
The right adrenal gland is identified just above the renal pole, lateral and posterior to the vena cava.

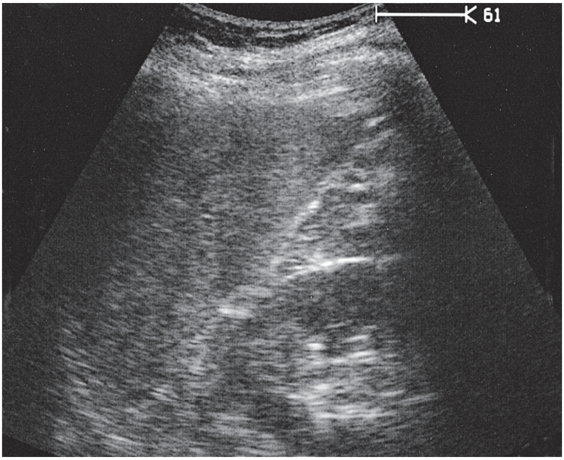
◀



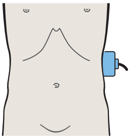
The right adrenal gland appears as a narrow, triangular, hypoechoic structure with an echodense rim.

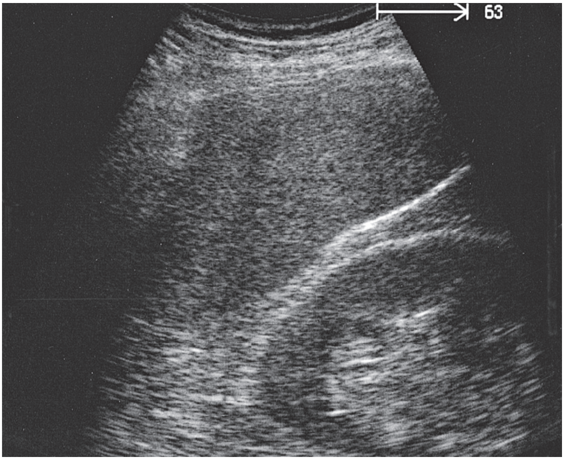
◀



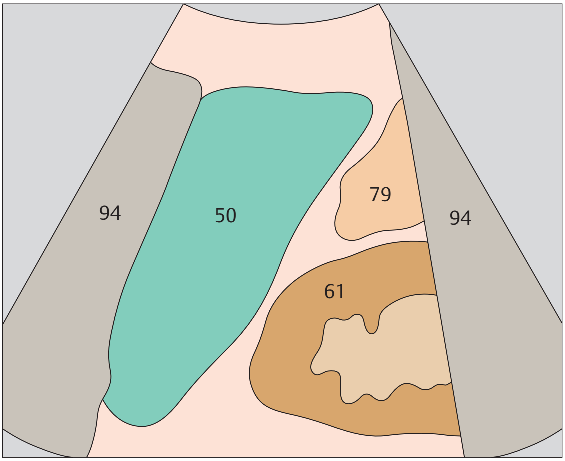


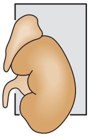
▶ **185** Kidney, spleen





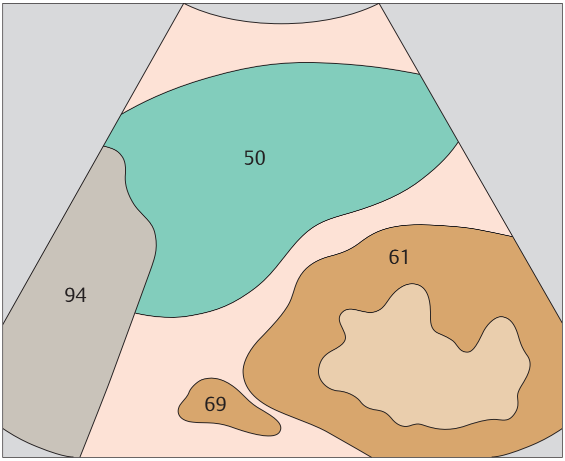
▶ **186** Adrenal gland, kidney, spleen





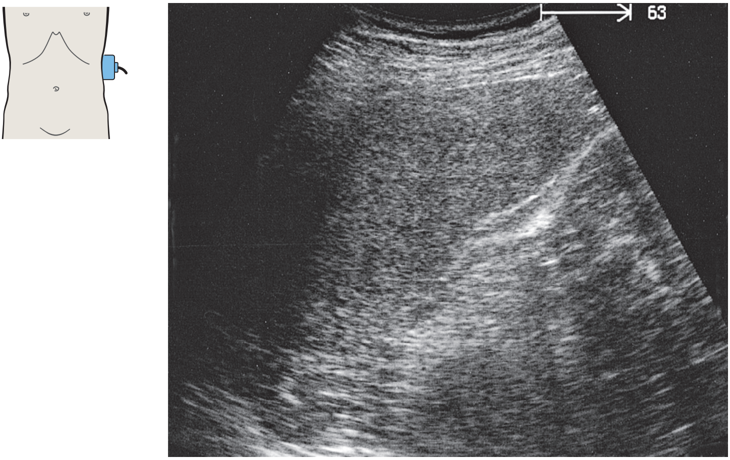
The left adrenal gland is usually more difficult to locate than the right adrenal gland.

◀

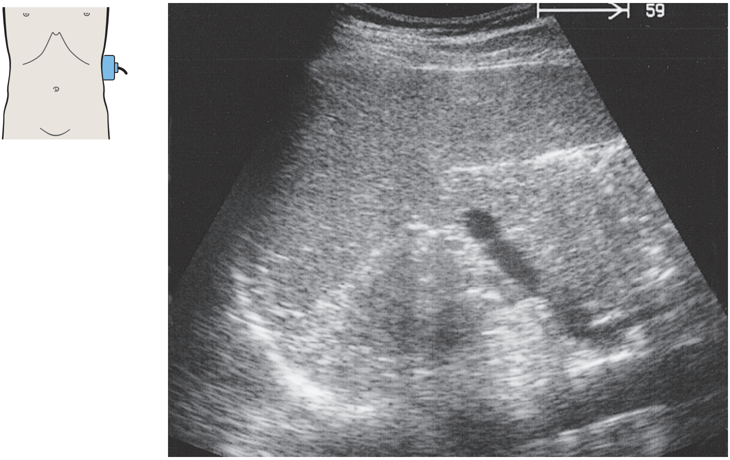


The left adrenal gland is identified between the upper renal pole, spleen, and aorta.

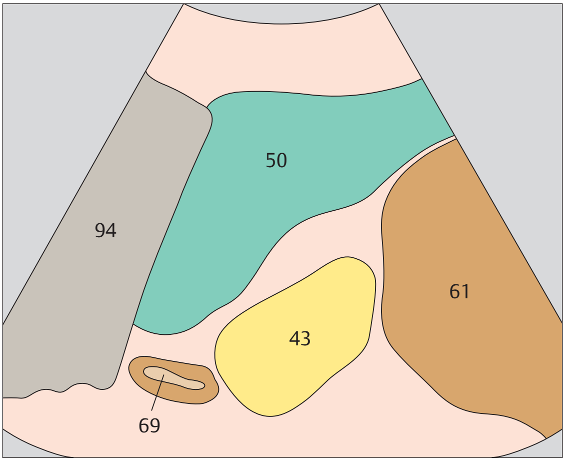
◀

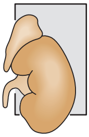


▶ **187** Adrenal gland, kidney, spleen

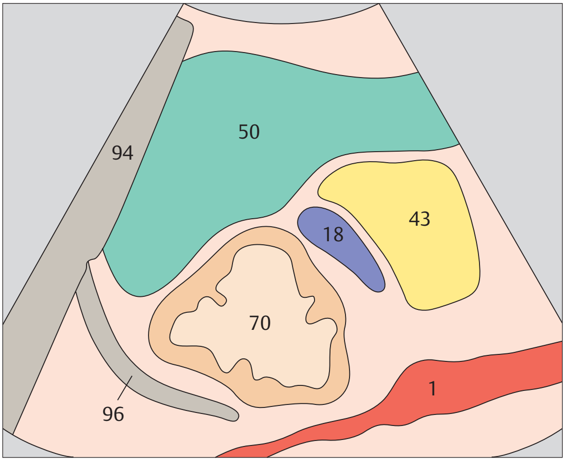


▶ **188** Spleen, tail of pancreas

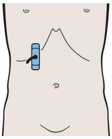

50
94
61
43
69

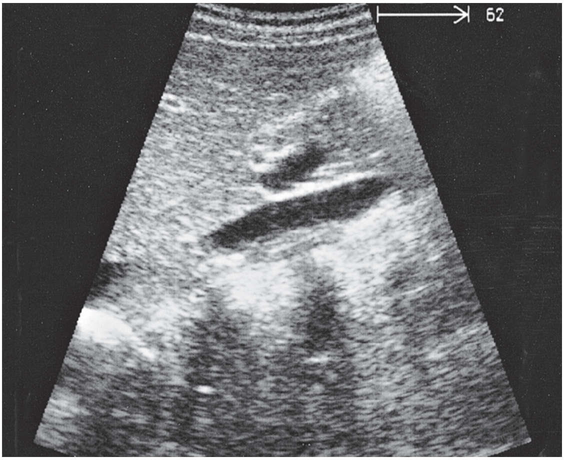


The left adrenal gland is frequently crescent-shaped.

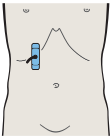

50
94
43
18
70
1
96

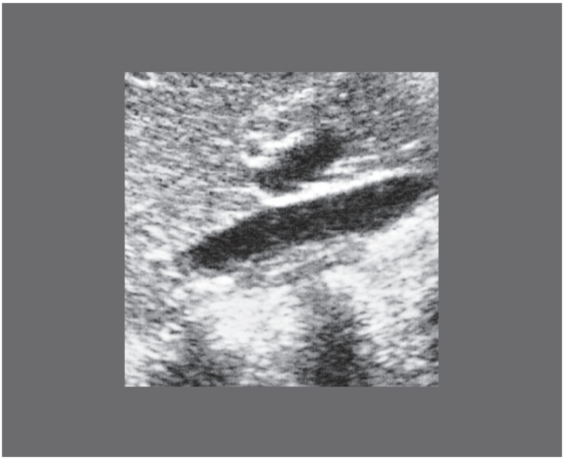
The left adrenal gland often extends relatively far downward toward the renal hilum.



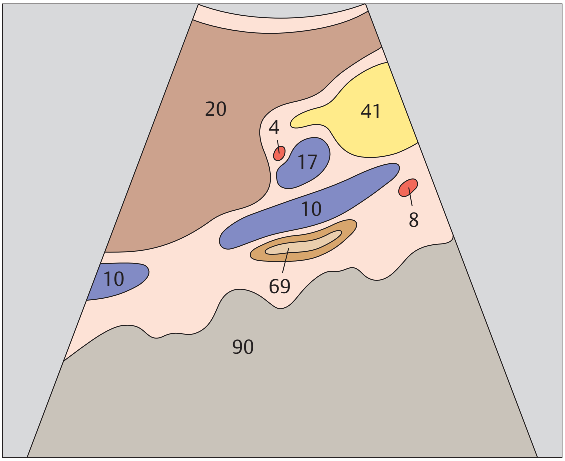


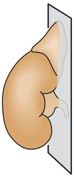
▶ **189** Layers of adrenal gland



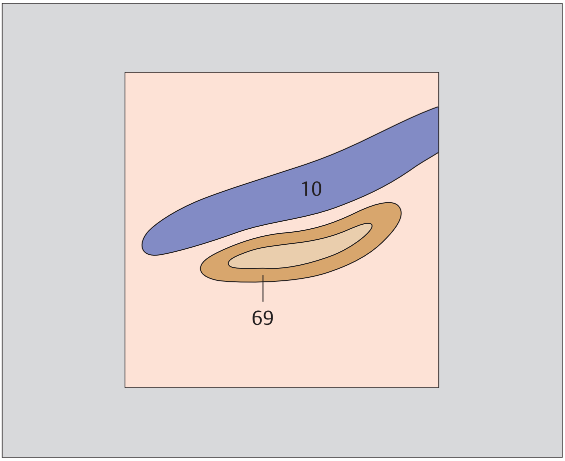


▶ **190** Layers of adrenal gland


20
41
4
17
10
8
10
69
90



The adrenal gland is seen to consist of three layers: two echodense outer layers and a hypoechoic middle layer.



The adrenal cortex is hypoechoic, and the medulla is hyperechoic.

8 Stomach

Upper Abdominal Transverse Scans of the Gastric Cardia from Above Downward

191 Esophagus, aorta, liver
192 Cardia, aorta, liver
193 Cardia, body of stomach, aorta, liver
194 Body of stomach, aorta, liver

Upper Abdominal Longitudinal Scans of the Stomach from Right to Left

195 Esophagus, aorta, liver
196 Esophagus, aorta, liver
197 Cardia, liver
198 Body of stomach, liver

Upper Abdominal Longitudinal Scans of the Stomach from Left to Right

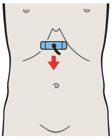
199 Body of stomach, liver
200 Antrum, liver, pancreas
201 Antrum, liver, pancreas
202 Pylorus, pancreas, liver
203 Duodenal bulb, liver, vena cava
204 Duodenum, gallbladder, vena cava

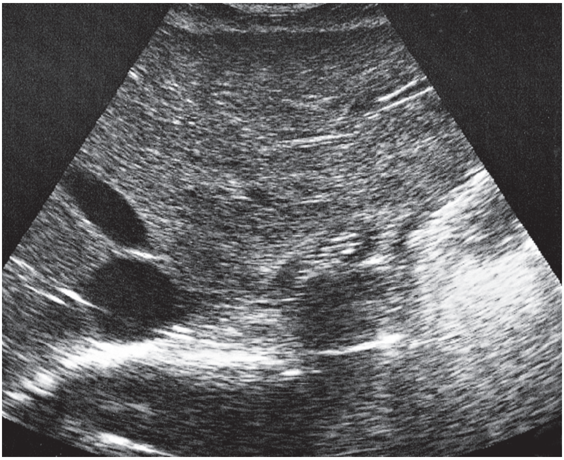
Upper Abdominal Transverse Scans of the Antrum and Duodenum from Above Downward

205 Antrum, liver, pancreas
206 Antrum, duodenum, liver, pancreas, gallbladder
207 Antrum, duodenum, liver, pancreas, gallbladder
208 Antrum, gallbladder

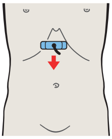
Details of the Stomach

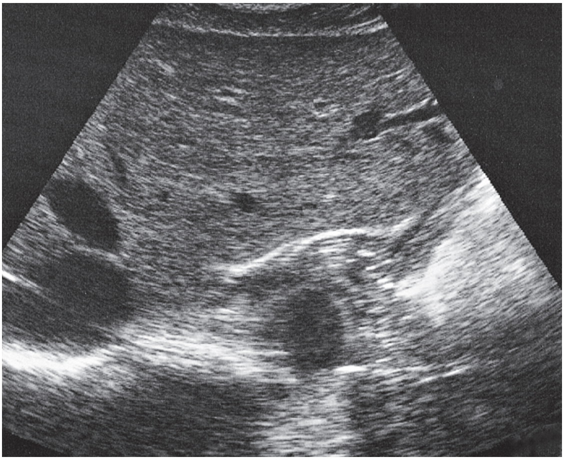
209 Layers of gastric wall
210 Layers of gastric wall
211 Gastric folds
212 Gastric folds



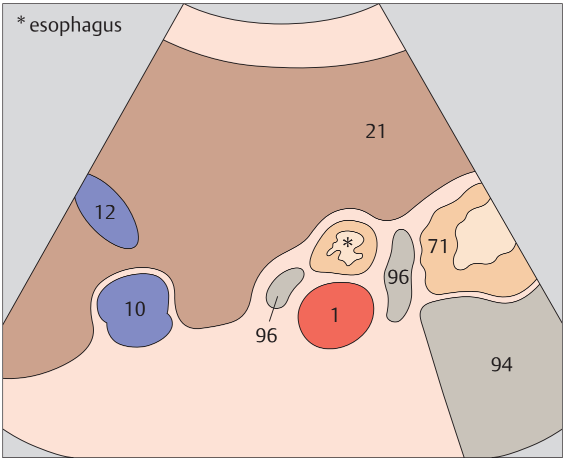


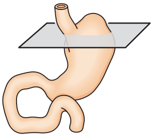
▶ **191** Esophagus, aorta, liver



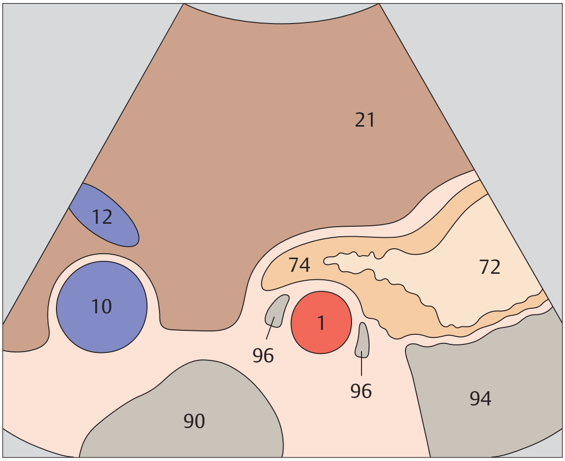


▶ **192** Cardia, aorta, liver

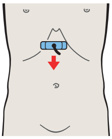

* esophagus
21
12
10
96
1
96
71
94
*

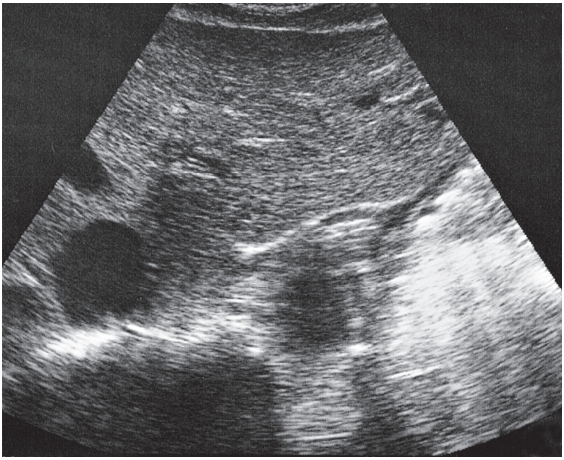


The gastroesophageal junction is identified between the liver, aorta, and diaphragmatic crura. ◀

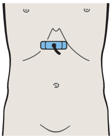

21
12
10
74
72
96
1
96
94
90

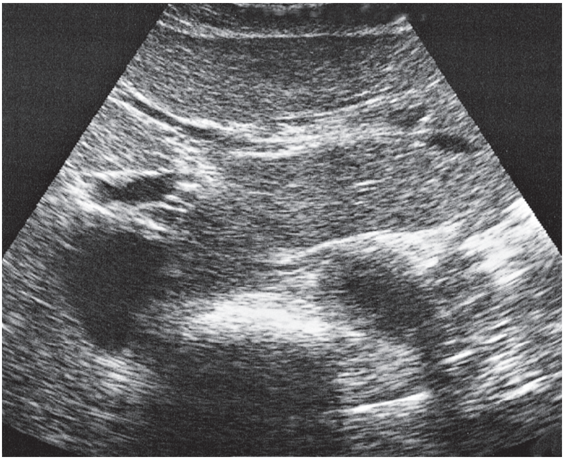
The cardia displays a typical pointed, triangular shape in transverse section. ◀



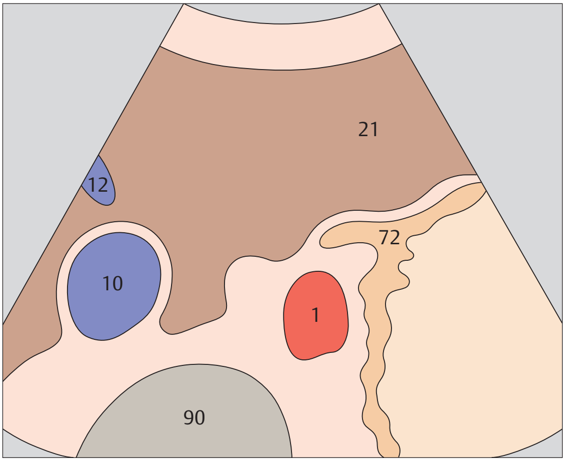


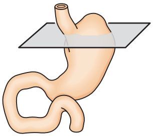
▶ **193** Cardia, body of stomach, aorta, liver



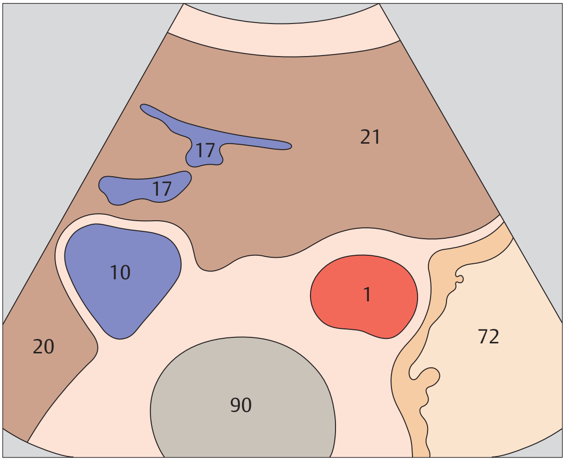


▶ **194** Body of stomach, aorta, liver

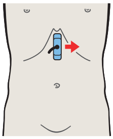

21
12
72
10
1
90

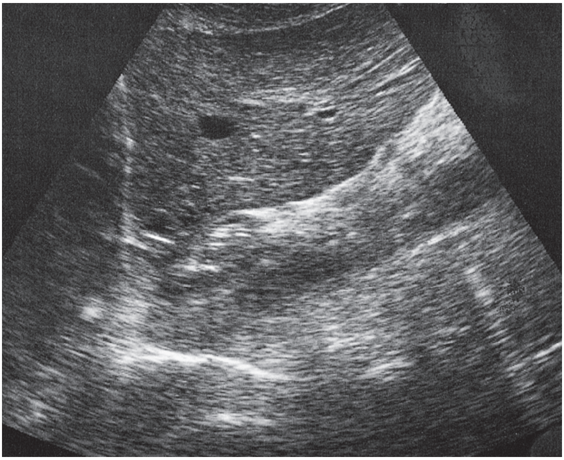


The cardia adjoins the body of the stomach, which presents a seemingly chaotic pattern of solid, liquid, and gaseous contents. ◀

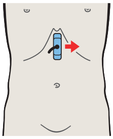

17
21
17
10
1
20
72
90

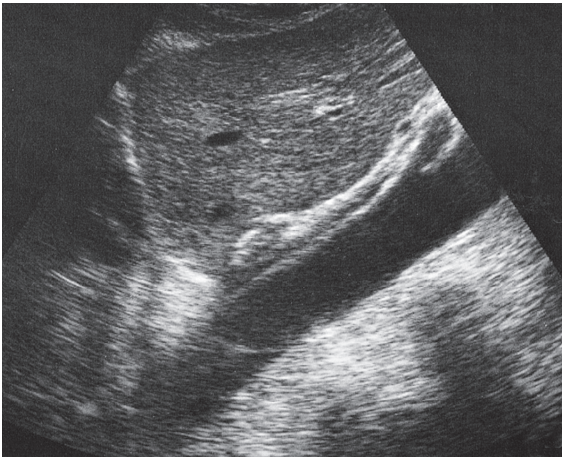
Below the cardia, the body of the stomach lies against the aorta. ◀



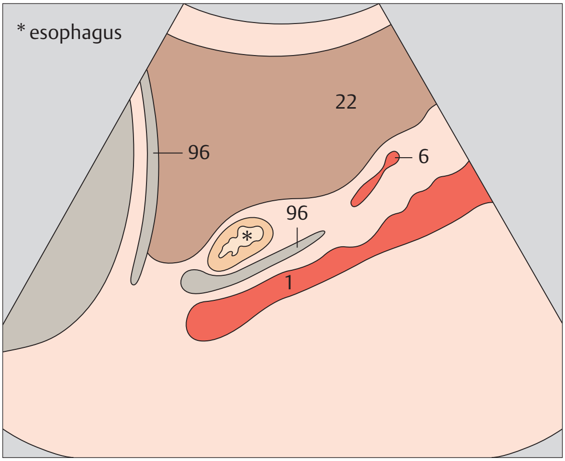


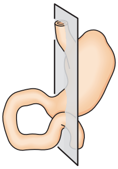
▶ **195** Esophagus, aorta, liver



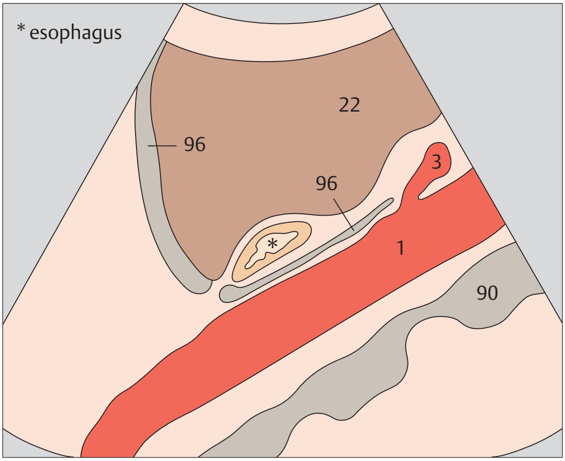


▶ **196** Esophagus, aorta, liver

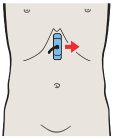

* esophagus
22
96
6
96
*
1

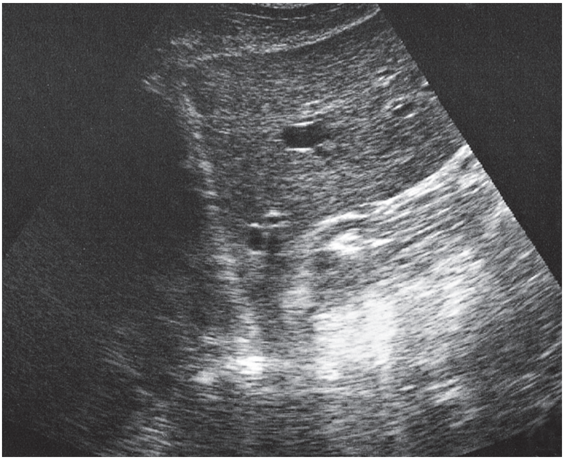


The abdominal esophagus is identified just anterior and to the right of the aorta.

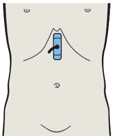

* esophagus
22
96
3
96
*
1
90

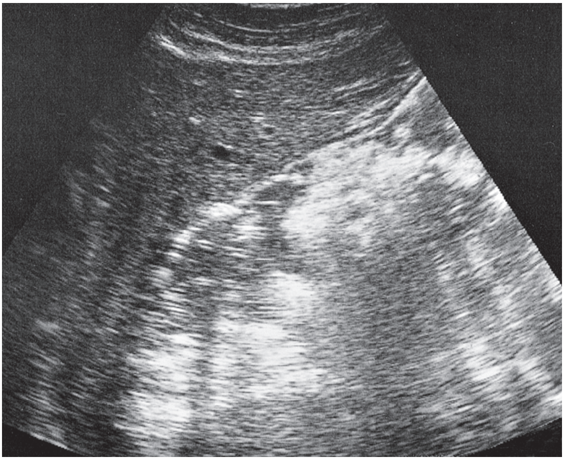
The esophagus and the cardia are located between the liver and aorta in the upper abdominal longitudinal scan.



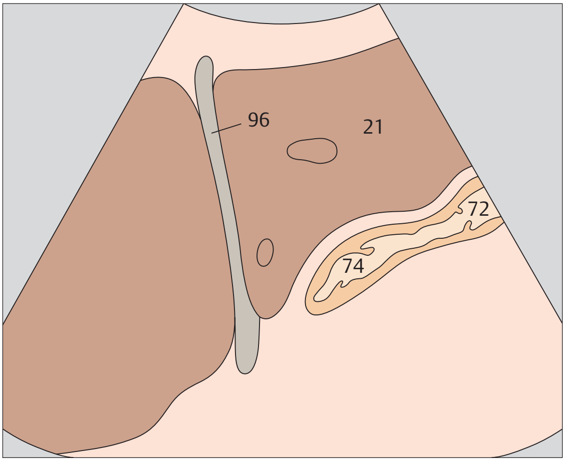


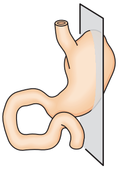
▶ **197** Cardia, liver



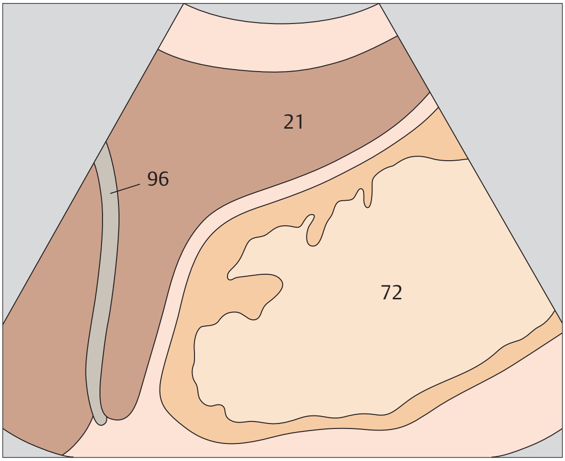


▶ **198** Body of stomach, liver

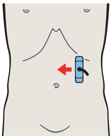


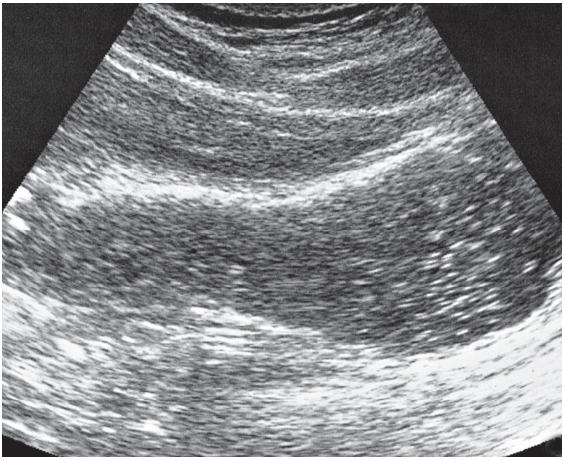


The first step in identifying the cardia and body of the stomach is to demonstrate the gastroesophageal junction.

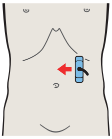


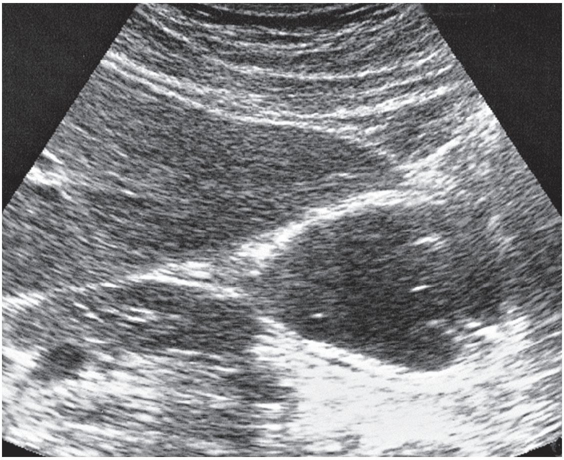
Without special patient preparation, the body of the stomach produces a heterogeneous echo pattern posterior to the left lobe of the liver.



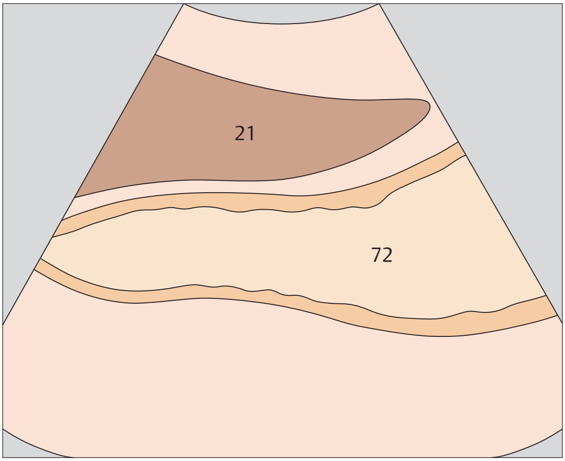


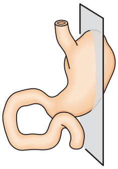
▶ **199** Body of stomach, liver





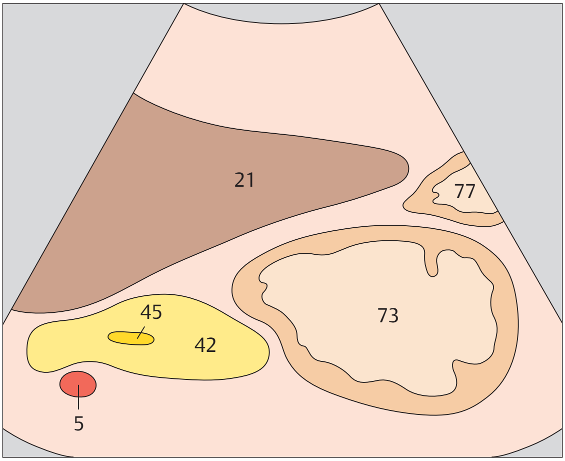
▶ **200** Antrum, liver, pancreas





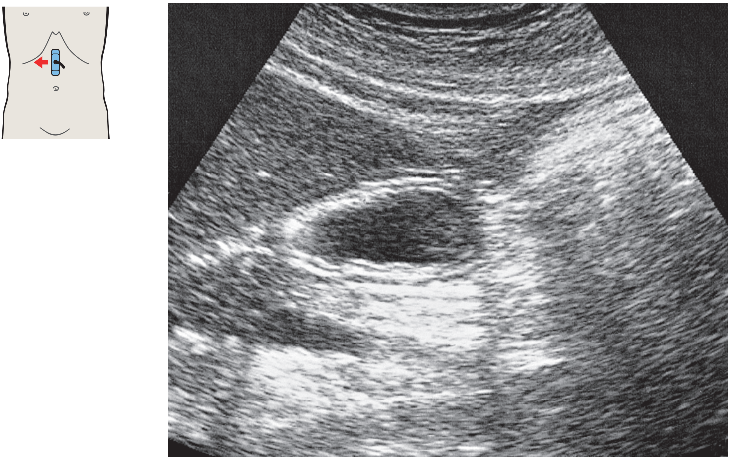
The body of the stomach is consistently located behind the left lobe of the liver. It may be fluid-filled and clearly defined, or empty and difficult to identify.

◀

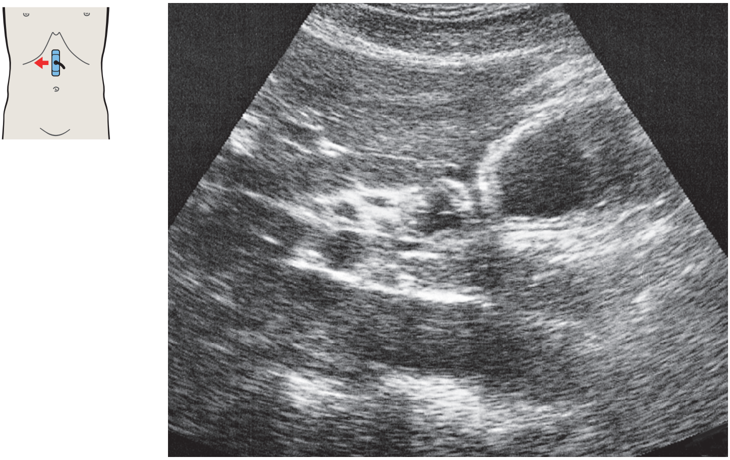


A longitudinal scan through the upper midabdomen demonstrates the characteristic triad of stomach, liver, and pancreas.

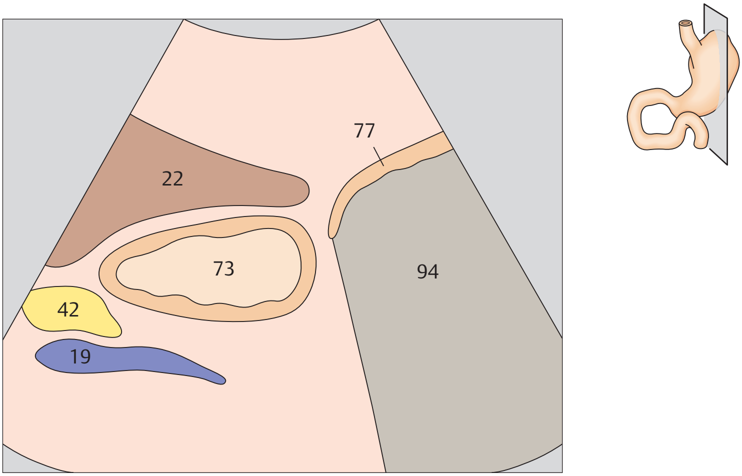
◀



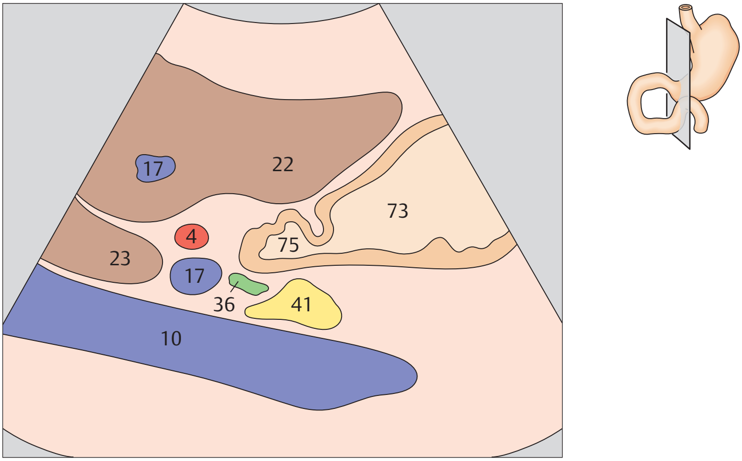
▶ **201** Antrum, liver, pancreas



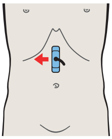
▶ **202** Pylorus, pancreas, liver

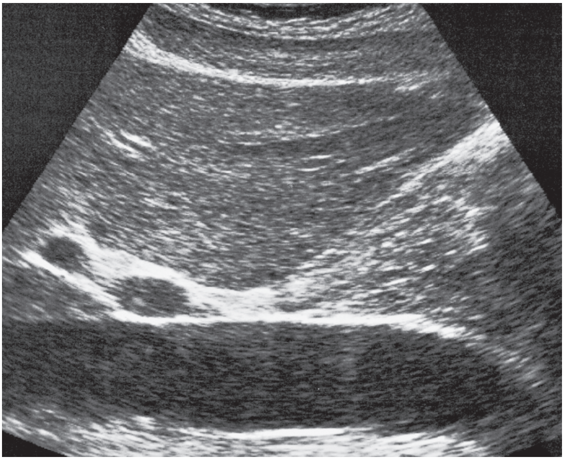

77
22
73
94
42
19

The typical target pattern of the gastric antrum is best appreciated in a longitudinal scan at the inferior border of the liver.

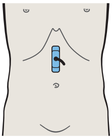

17
22
73
4
75
23
17
36
41
10

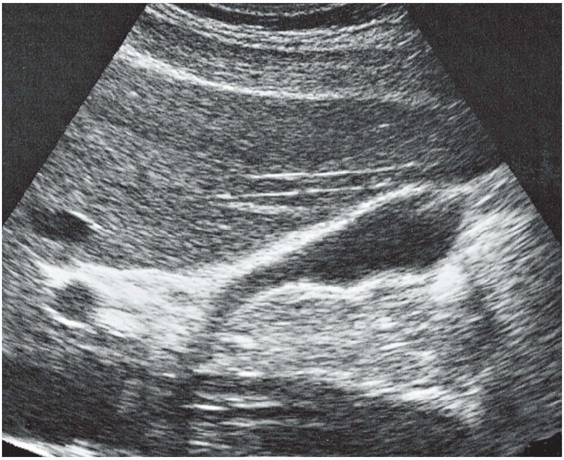
The pylorus is characterized by a marked thickening of the muscular coat anterior to the head of the pancreas.



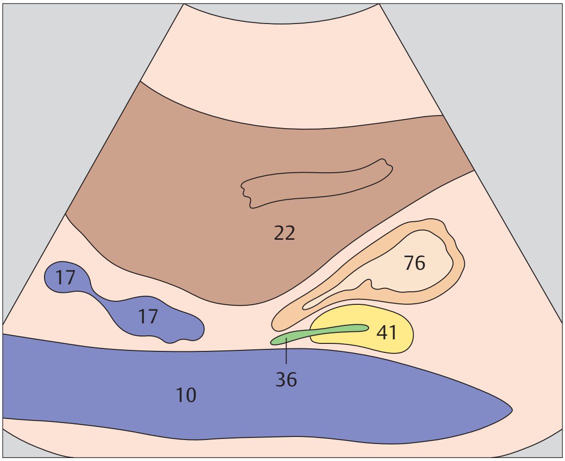


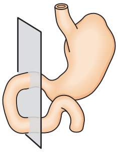
▶ **203** Duodenal bulb, liver, vena cava



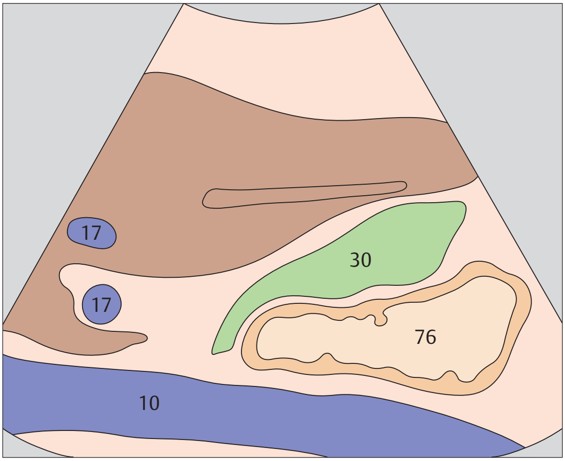


▶ **204** Duodenum, gallbladder, vena cava


22
76
17
17
41
36
10



The duodenal bulb runs laterally upward and backward before joining the second part of the duodenum. ◀


17
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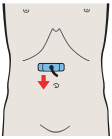
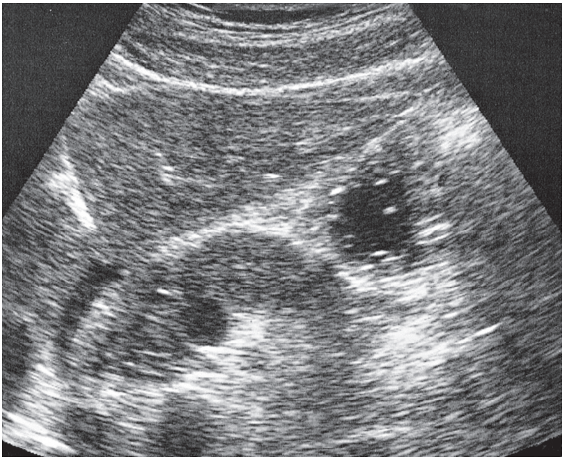
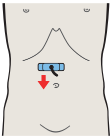
17
76
10

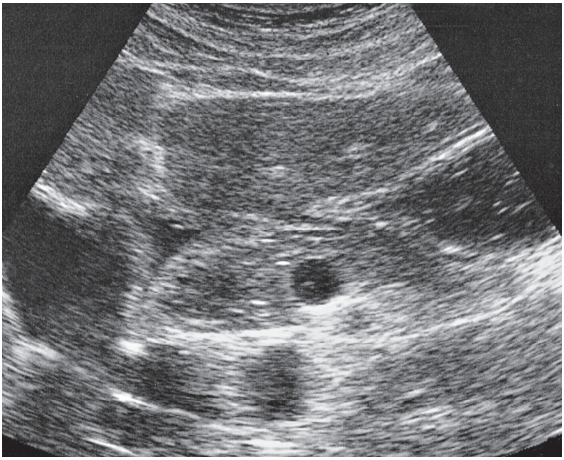
The second part of the duodenum is displayed posterior to the gallbladder. ◀



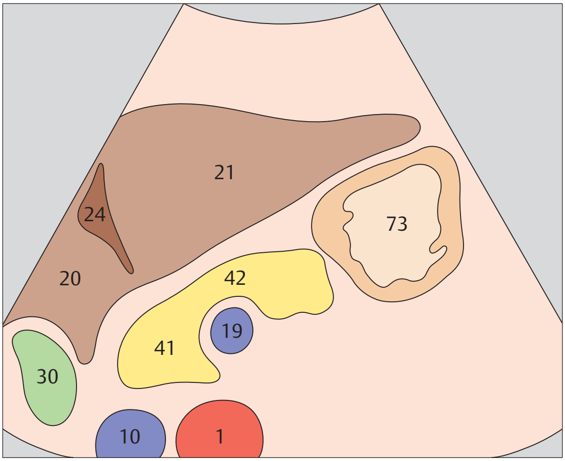


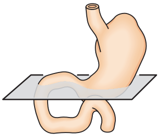
▶ **205** Antrum, liver, pancreas



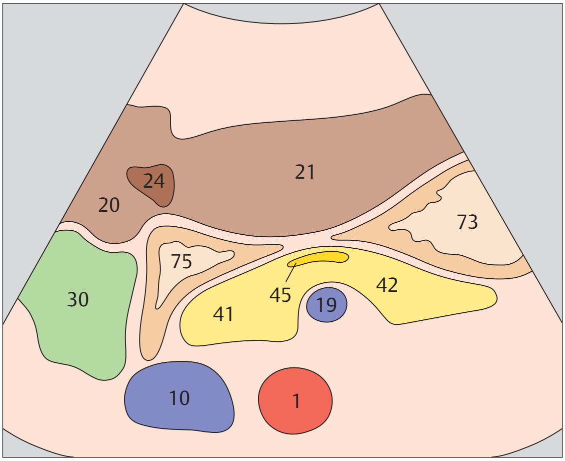


▶ **206** Antrum, duodenum, liver, pancreas, gallbladder


21
24
73
20
42
19
41
30
10
1



The pancreas lies against the posterior surface of the stomach.


21
24
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75
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42
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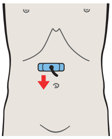
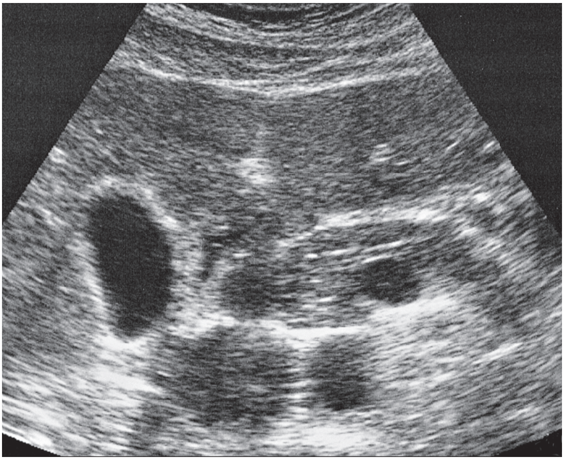
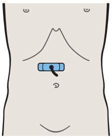
19
41
10
1

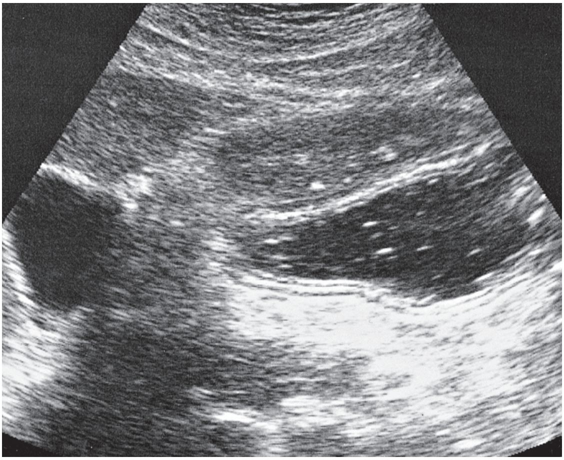
The antrum extends to the right, coming between the pancreas and liver. It is difficult to visualize at that location.



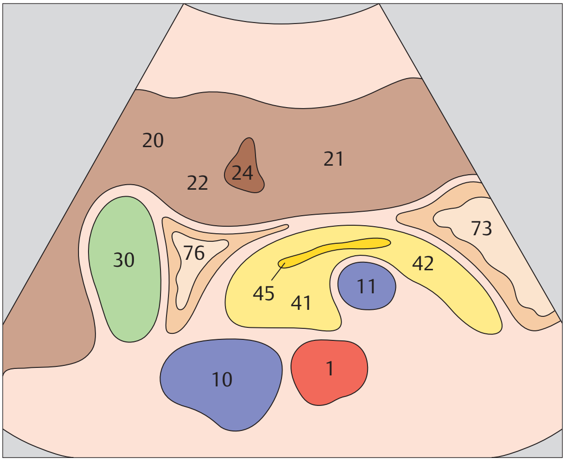


▶ **207** Antrum, duodenum, liver, pancreas, gallbladder





▶ **208** Antrum, gallbladder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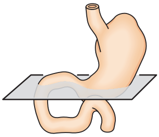
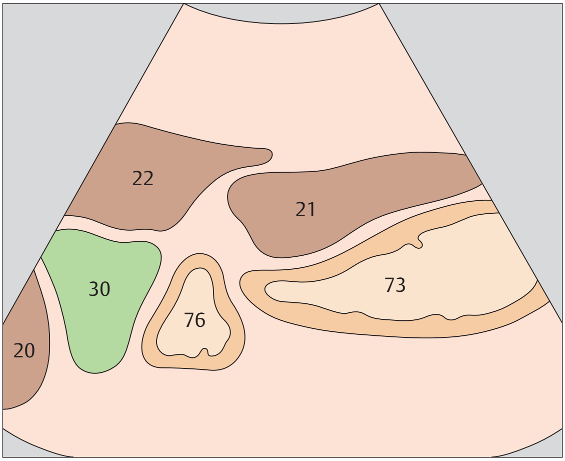


The second part of the duodenum lies between the liver, gallbladder, vena cava, and head of pancreas.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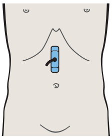
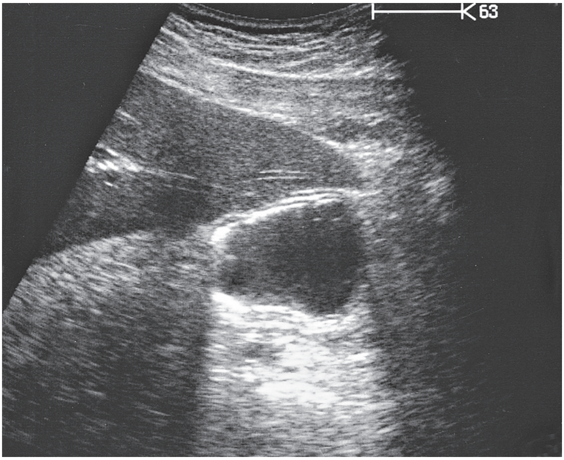
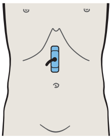
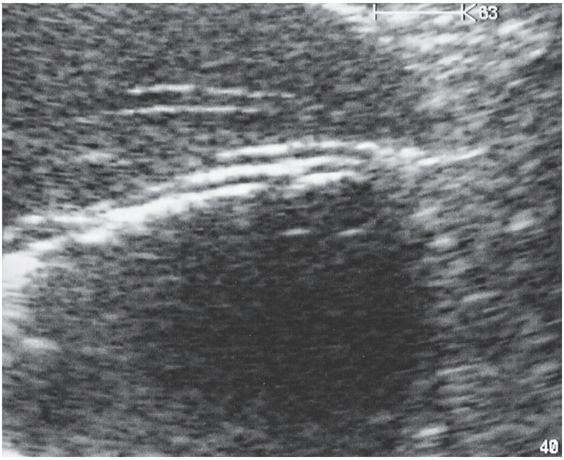
The antrum often extends quite far downward, especially when the stomach is full and the subject is standing upright.



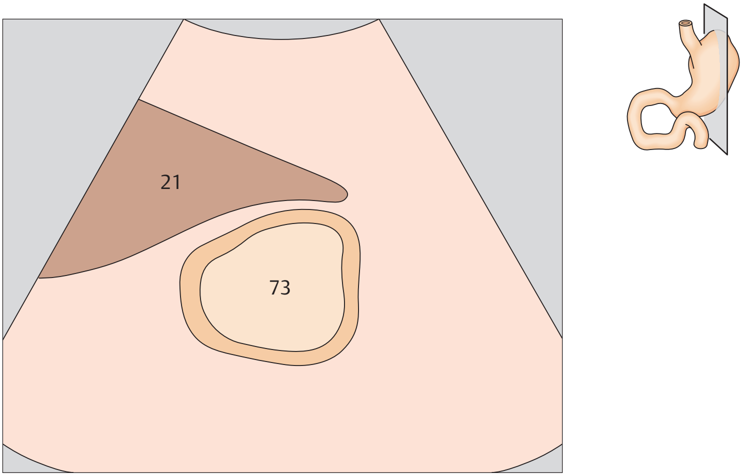


▶ **209** Layers of gastric wall

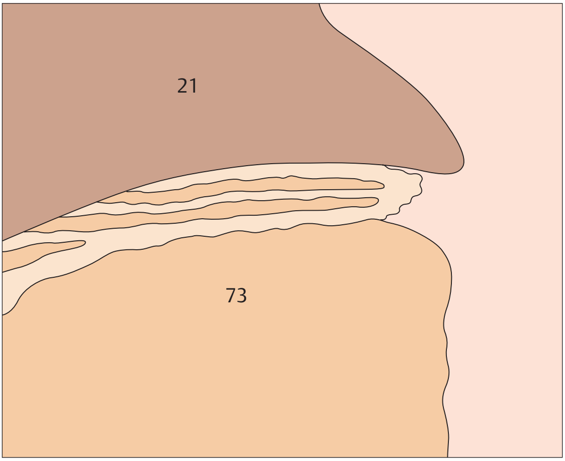




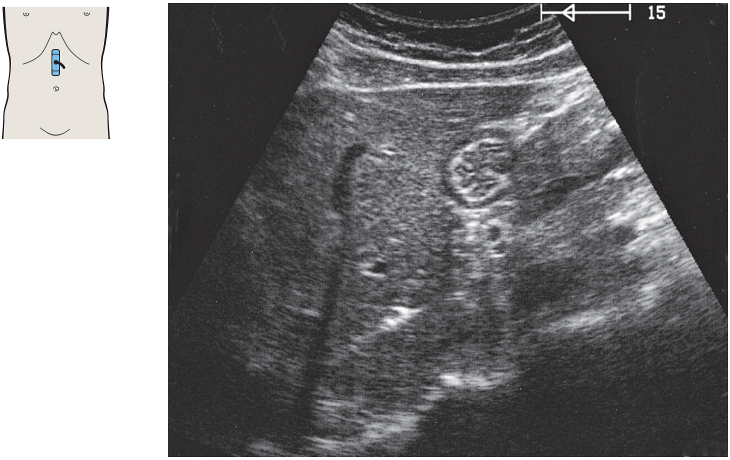
▶ **210** Layers of gastric wall



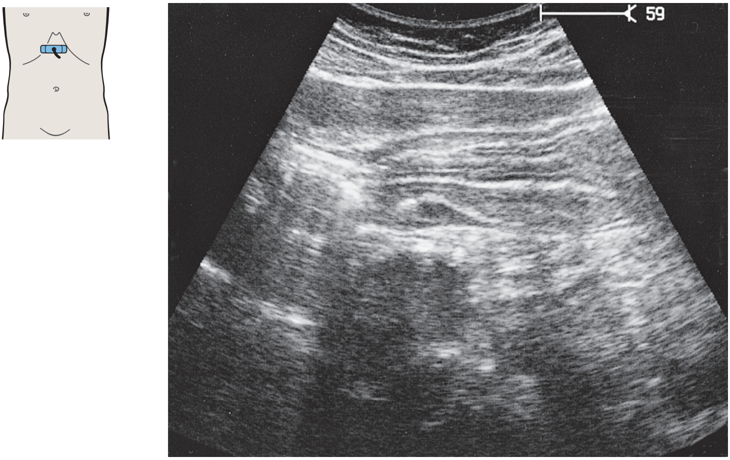
With a high-resolution device and favorable scanning conditions, five layers can be distinguished in the gastric wall.



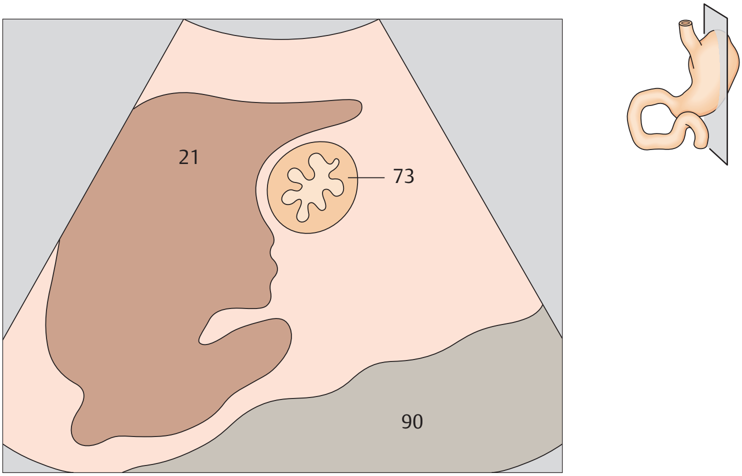
A scan through the antrum is best for differentiating the layers of the gastric wall.



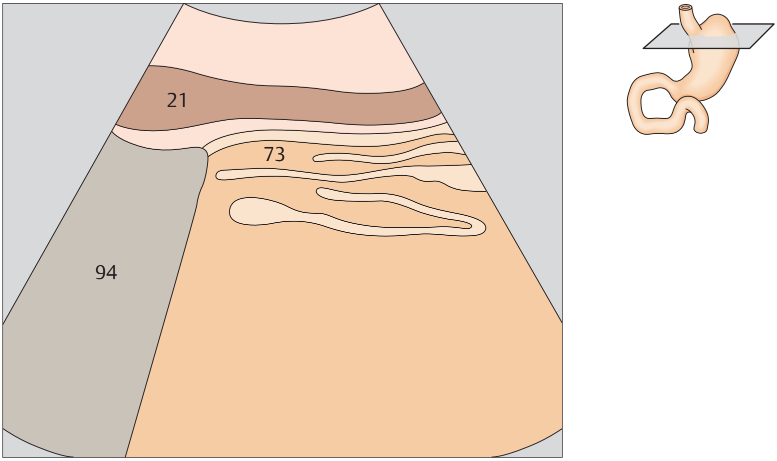
▶ **211** Gastric folds



▶ **212** Gastric folds



The rugal folds of the stomach are demonstrated most clearly in the fasted state.



In an upper abdominal transverse scan, the gastric folds produce a confusing pattern in which numerous wall layers are seen.

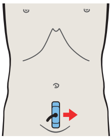
9 Bladder

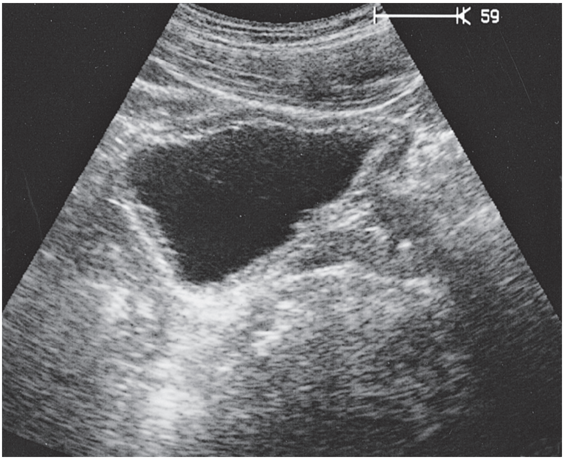
Bladder in Longitudinal Sections

213 Bladder, prostate, rectum
214 Bladder, ureteral orifice, prostate, rectum
215 Bladder, rectum
216 Bladder, bowel

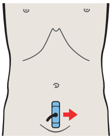
Details of the Bladder

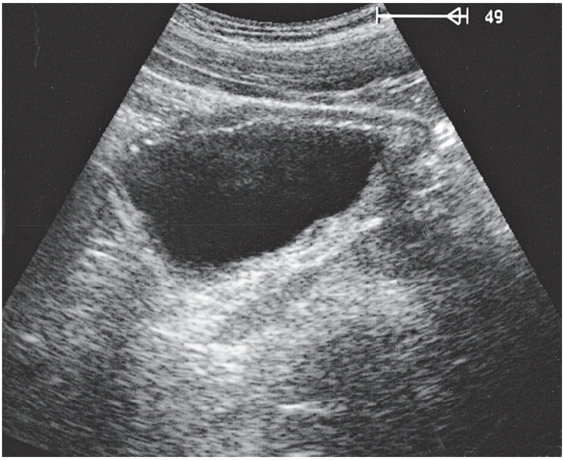
217 Bladder, ureteral orifices
218 Bladder, inflow of urine



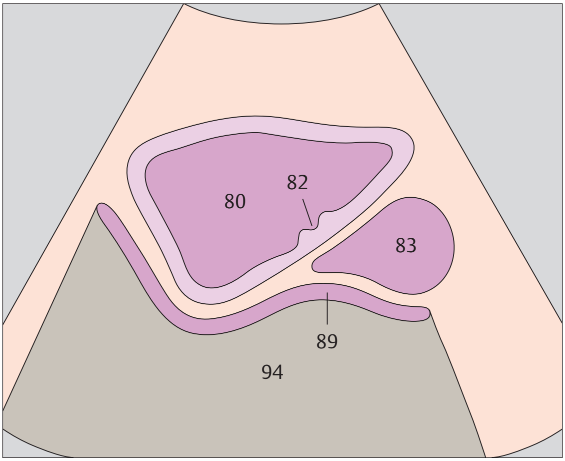


▶ **213** Bladder, prostate, rectum





▶ **214** Bladder, ureteral orifice, prostate, rectum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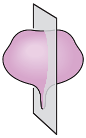
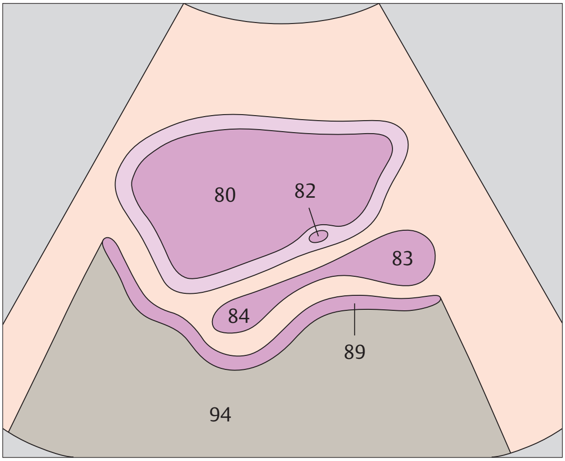
82
83
89
94



The full bladder appears in longitudinal section as a triangular structure devoid of internal echoes.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82
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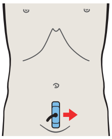
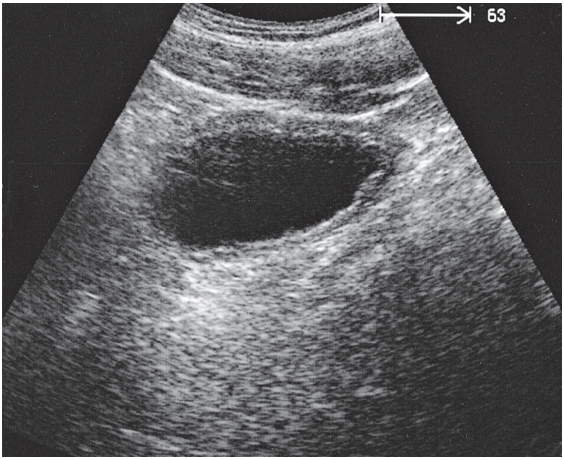
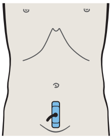
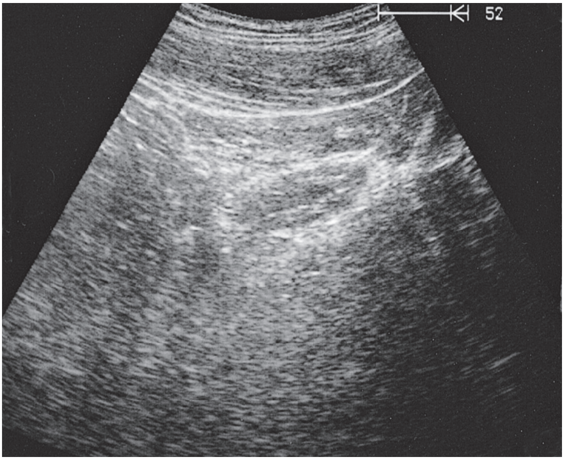
The internal genitalia are seen posterior to the bladder in the midsagittal scan.



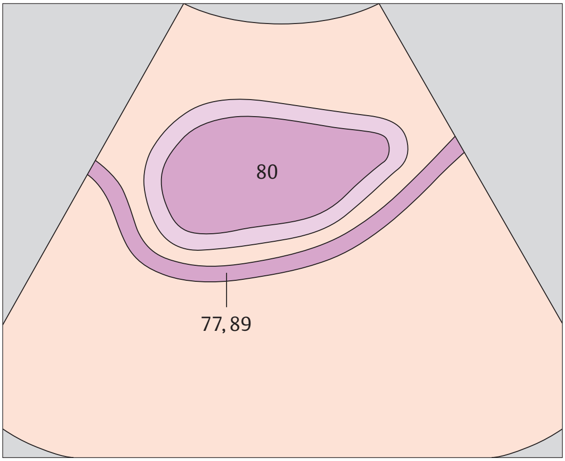


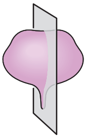
▶ **215** Bladder, rectum



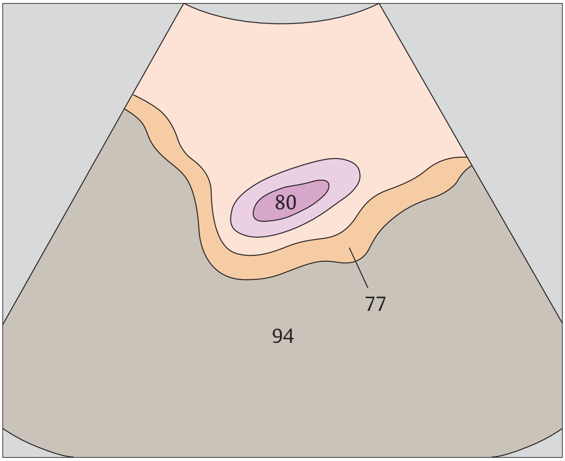


▶ **216** Bladder, bowel

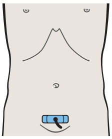


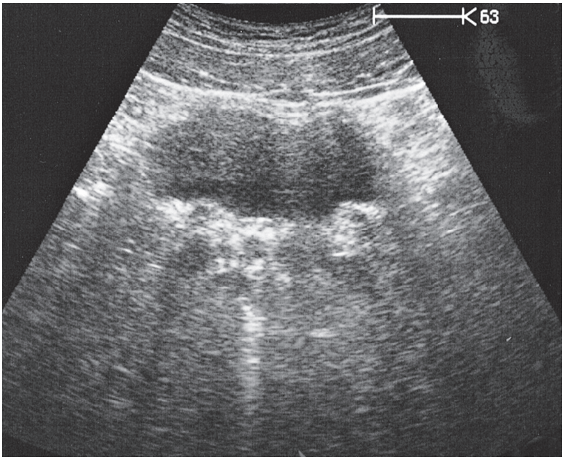


The anterior wall of the bladder is loosely attached to the anterior abdominal wall by the vesicoumbilical fascia. This keeps gas-containing bowel loops from coming between the abdominal wall and the anterior surface of the full bladder.

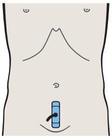


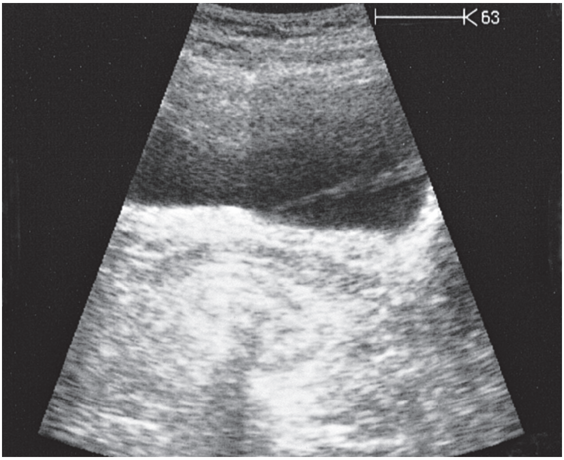
Bowel loops containing gas are seen posterior to the bladder in the lateral scan.



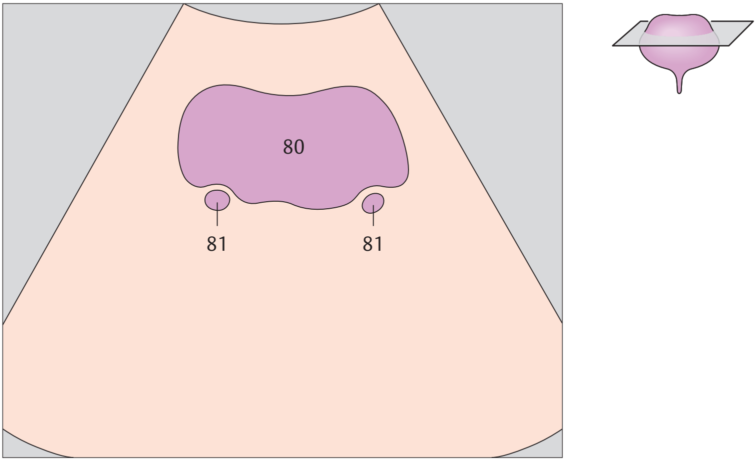


▶ **217** Bladder, ureteral orifices

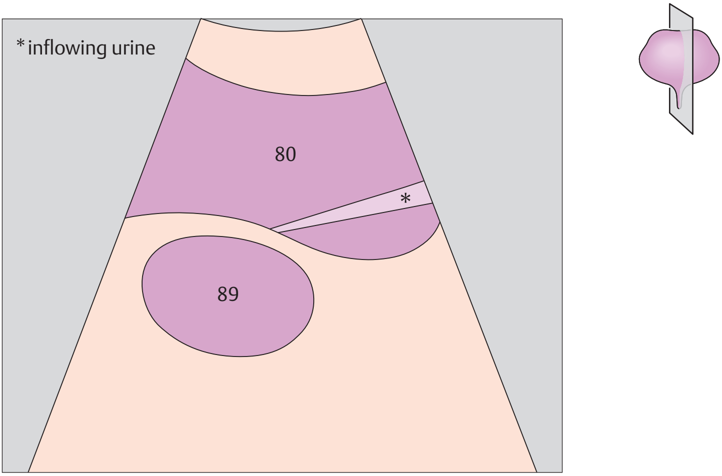




▶ **218** Bladder, inflow of urine



The ureters appear as fine tubular structures in the posterior bladder wall.


* inflowing urine
80
*
89

Ultrasound can often demonstrate urine flowing into the bladder from a ureteral orifice.

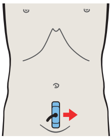
10 Prostate

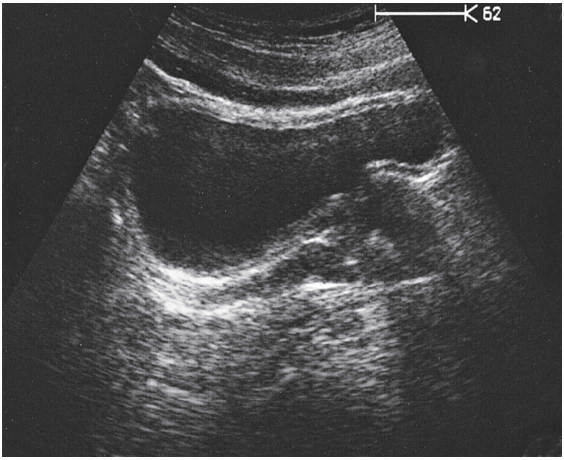
Prostate in Longitudinal Sections

219 Prostate, rectum, bladder
220 Prostate, rectum, bladder
221 Prostate, seminal vesicles
222 Prostate, seminal vesicles

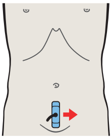
Prostate in Transverse Sections

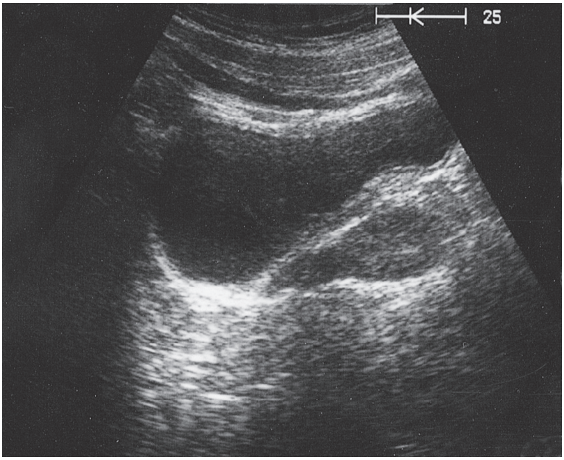
223 Prostate, urethra, bladder
224 Prostate, urethra, bladder
225 Prostate, bladder
226 Seminal vesicles, bladder



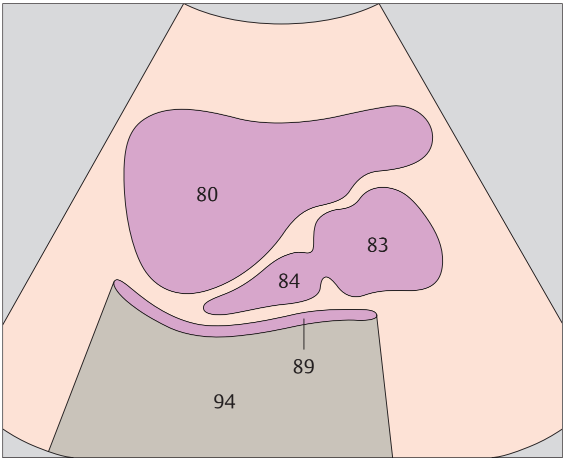


▶ **219** Prostate, rectum, bladder





▶ **220** Prostate, rectum, bladder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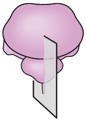
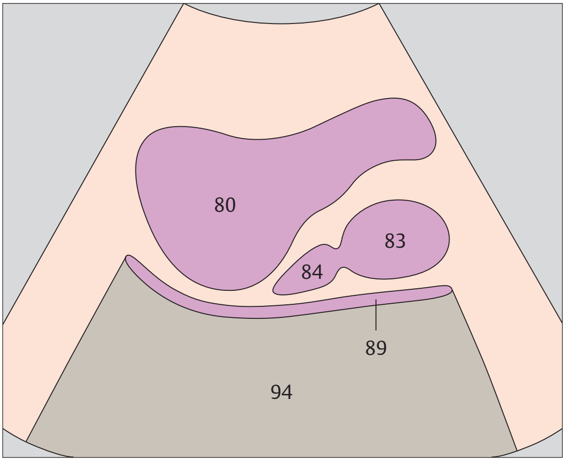


The prostate appears onion-shaped in longitudinal section.


80
83
84
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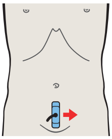
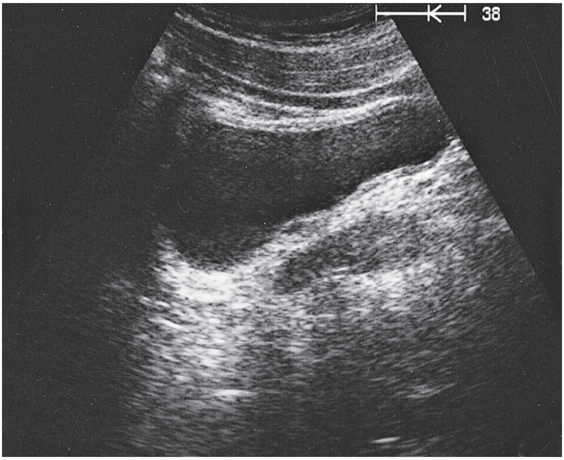
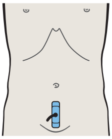
94

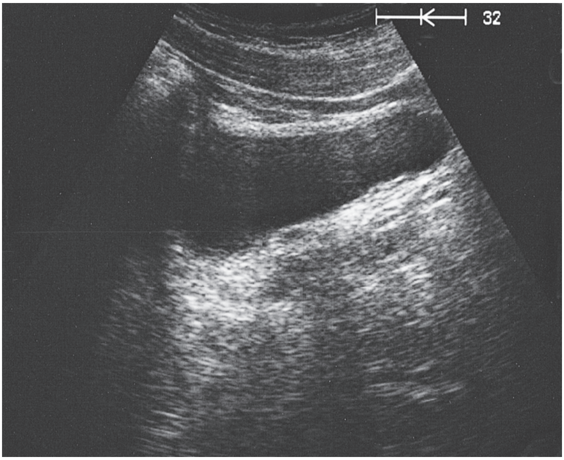
*Behind the prostate is the rectum,
usually appearing as a gas-filled structure.*



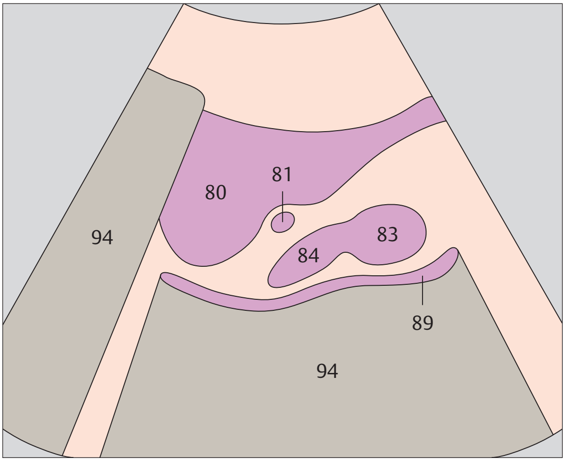


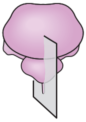
▶ **221** Prostate, seminal vesicles





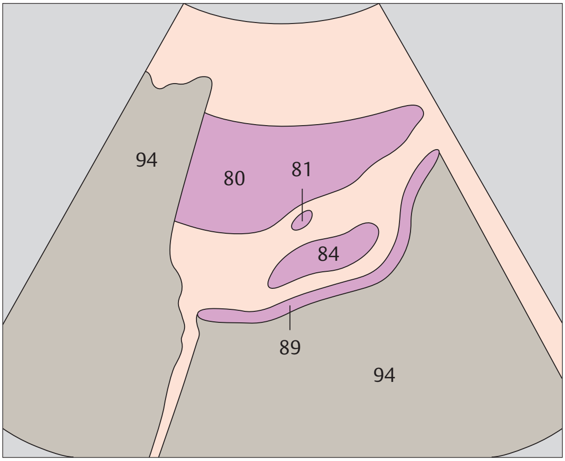
▶ **222** Prostate, seminal vesicles


81
80
94
83
84
89
94



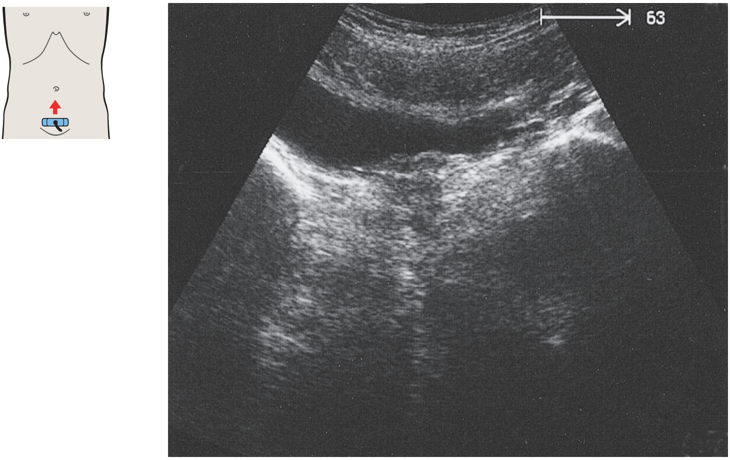
The seminal vesicles are in contact with the bladder over their entire length.

◀

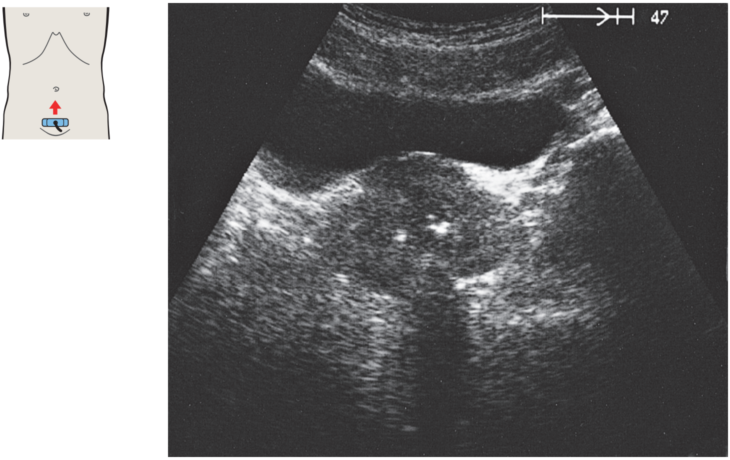

94
80
81
84
89
94

The seminal vesicles are located lateral and cranial to the prostate.

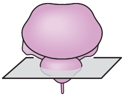
◀

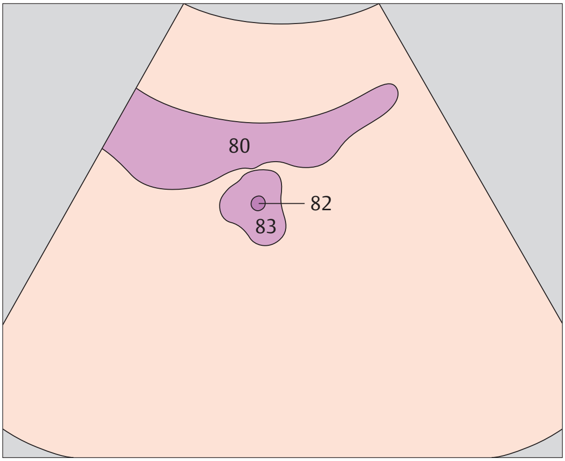


► **223** Prostate, urethra, bladder

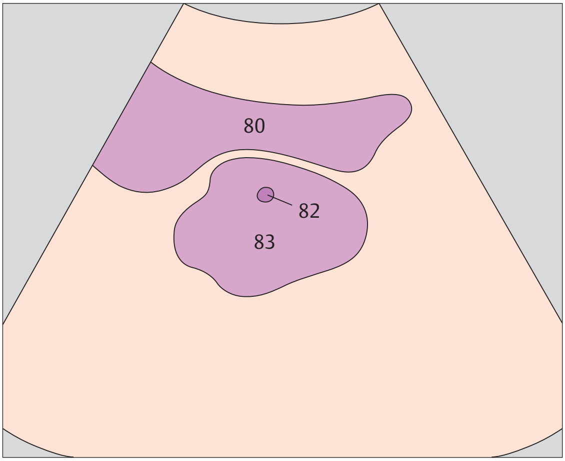


► **224** Prostate, urethra, bladder

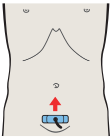


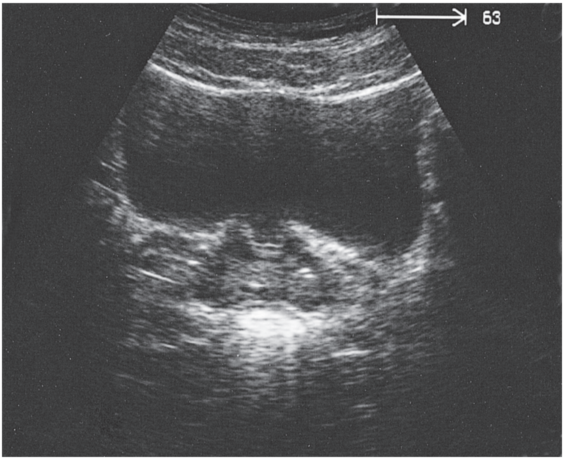


The urethra can be identified as a hypoechoic round structure within the prostate.

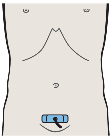


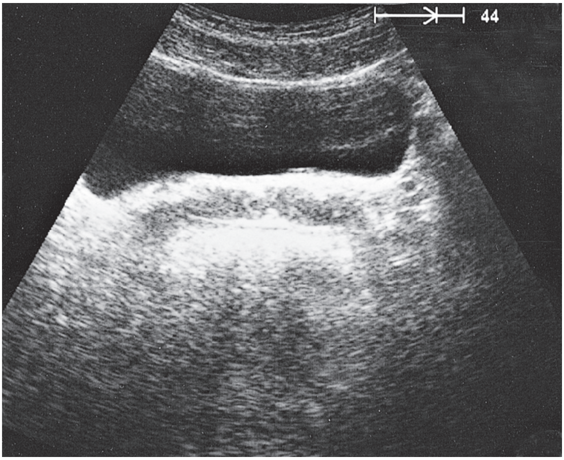
The prostate presents an oval, chestnut-like shape in cross section.



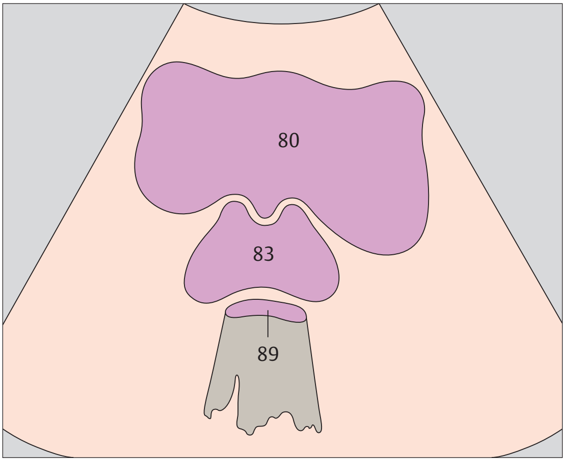


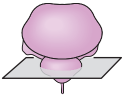
▶ **225** Prostate, bladder



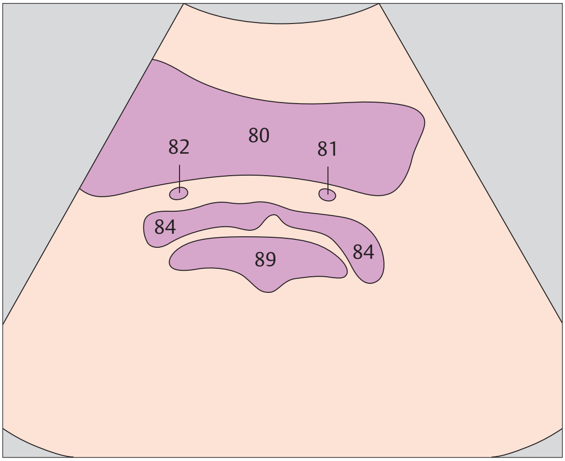


▶ **226** Seminal vesicles, bladder





The middle lobe of the prostate with the urethral orifice may protrude somewhat into the bladder.



The seminal vesicles, around 5 cm long and 1 cm thick, can be seen on the posterior wall of the bladder.

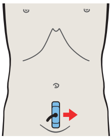
11 Uterus

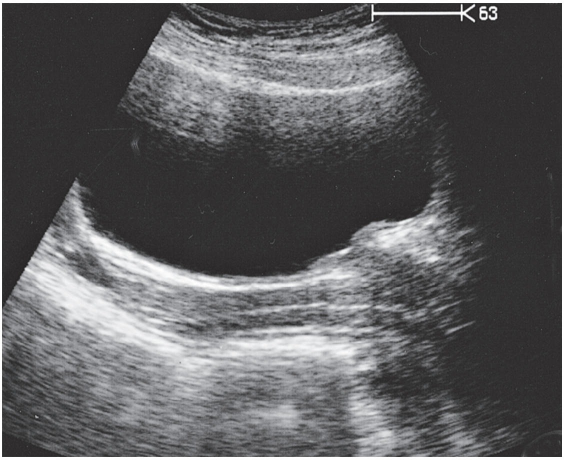
Uterus in Longitudinal Sections

227 Vagina, bladder
228 Vagina, uterus, bladder
229 Vagina, uterus, bladder
230 Uterus, bladder
231 Uterus, ovary, bladder
232 Bladder, ovary

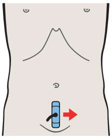
Uterus in Transverse Sections

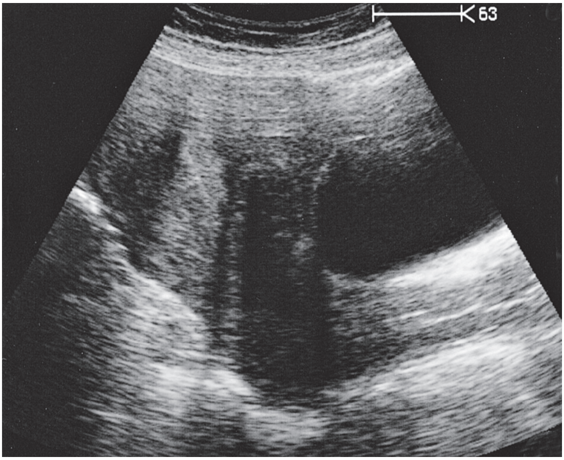
233 Vagina, bladder, rectum
234 Uterus, bladder, rectum
235 Uterus, bladder, rectum, ovary
236 Uterus, bladder, rectum, ovaries



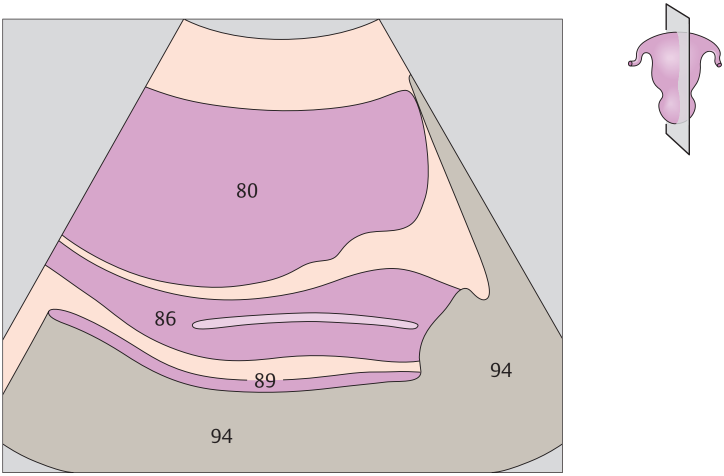


▶ **227** Vagina, bladder

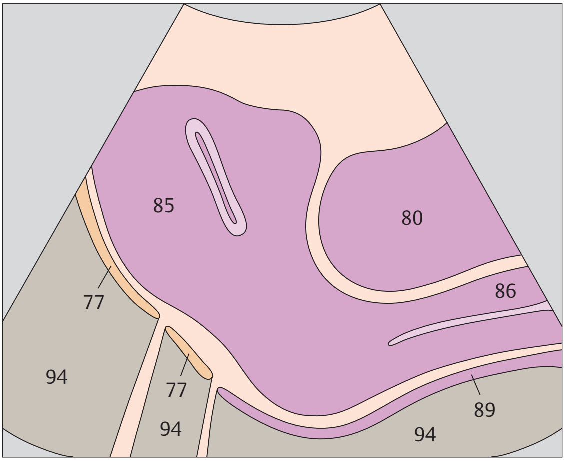




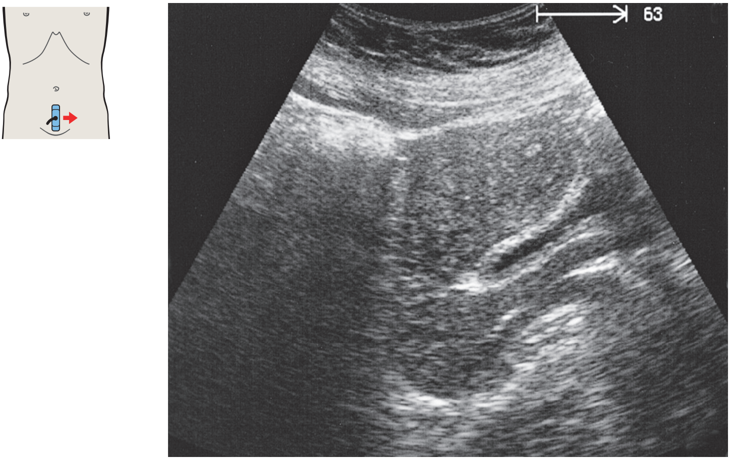
▶ **228** Vagina, uterus, bladder


80
86
89
94
94

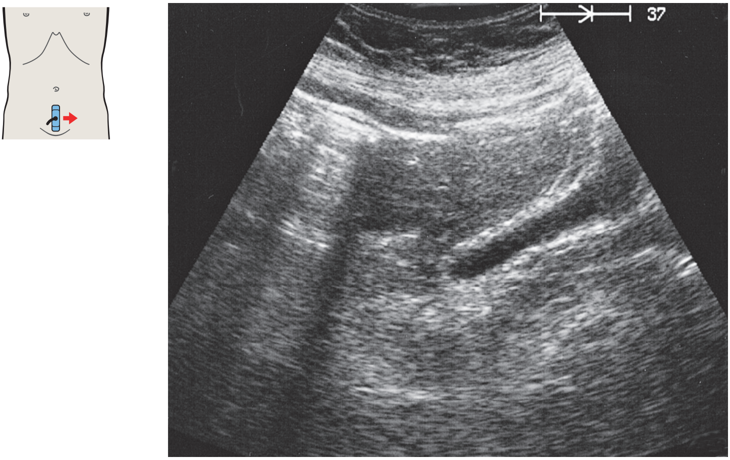
The vagina appears posterior to the bladder as an elongated, hypoechoic structure with a more echogenic central band.


85
80
86
77
77
94
94
89
94

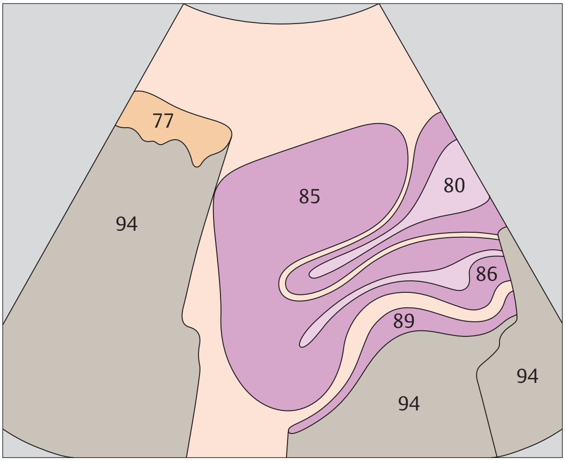
The uterine cavity can be visualized with ultrasound only during menstruation or pregnancy.

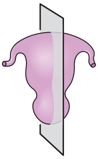


▶ **229** Vagina, uterus, bladder

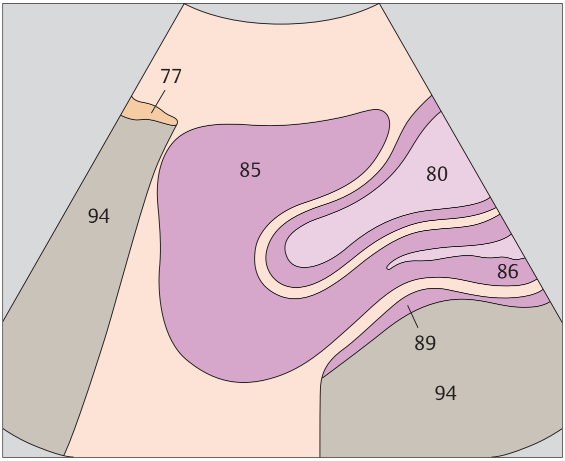


▶ **230** Uterus, bladder

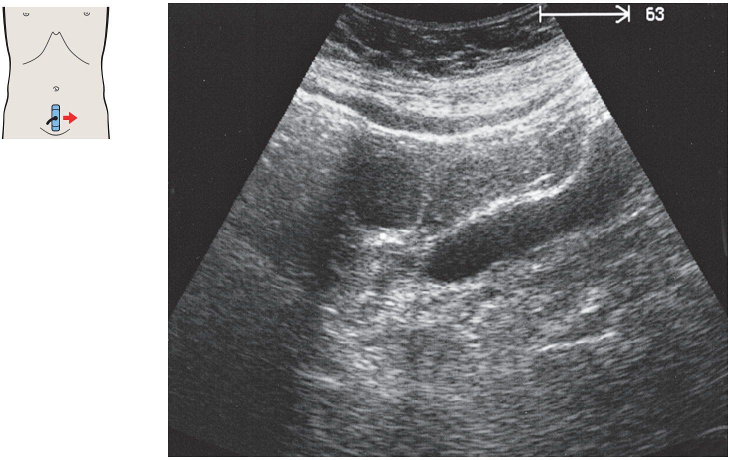




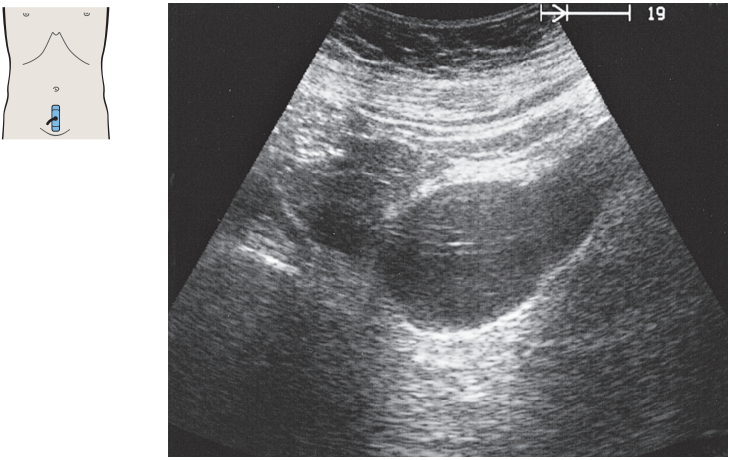
The uterus is seen to consist of a fundus, corpus, and cervix.



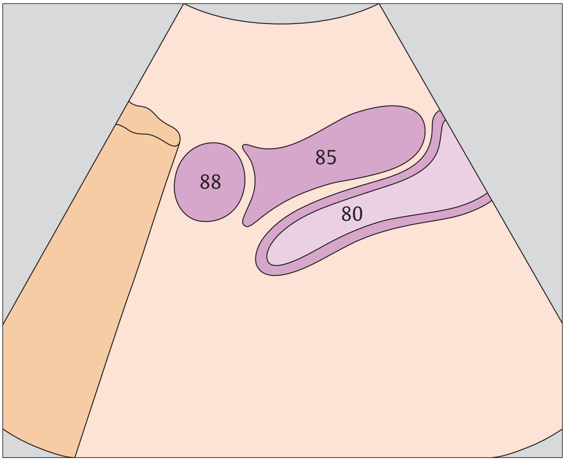
In most cases the uterus is anteflexed and is located cranial and posterior to the bladder, lying between it and the rectum and small bowel. The uterine corpus merges at a variable angle with the cervix, which widens slightly in its vaginal portion.

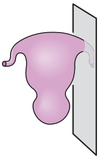


▶ **231** Uterus, ovary, bladder

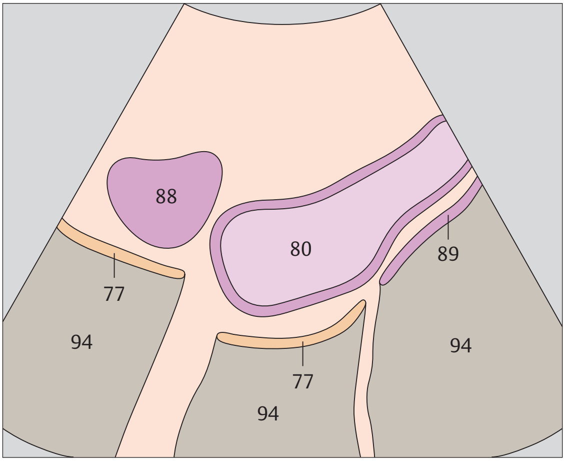


▶ **232** Bladder, ovary



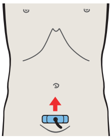


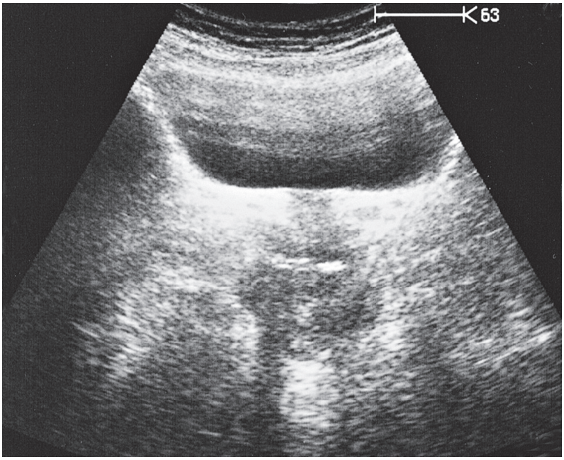
As the scan moves laterally across the uterus, the ovary comes into view at its superior border.



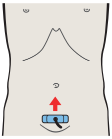
88
80
77
89
94
94
77
94
94

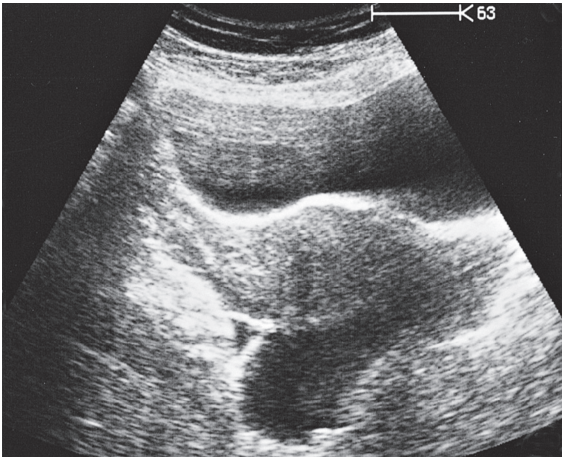
The ovaries are situated laterally at the upper edge of the full bladder.



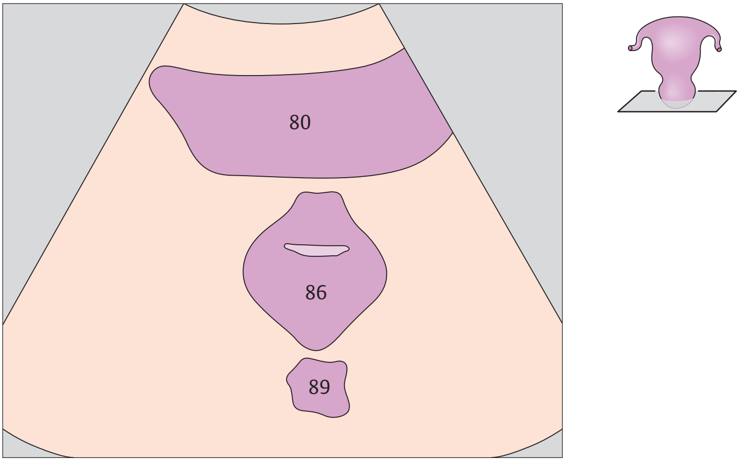


▶ **233** Vagina, bladder, rectum

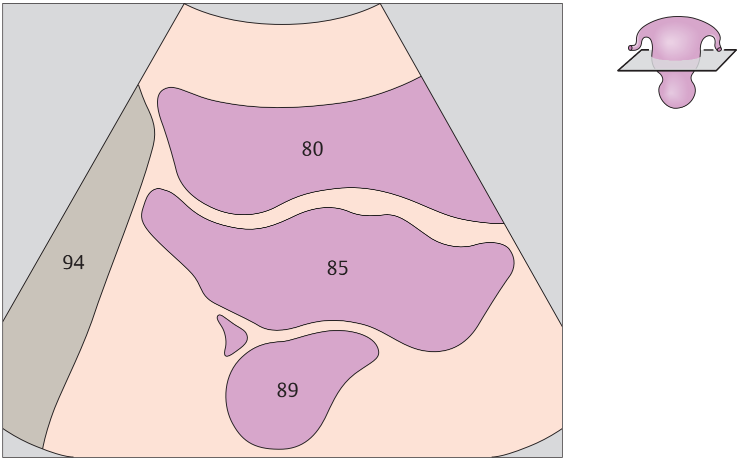




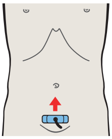
▶ **234** Uterus, bladder, rectum

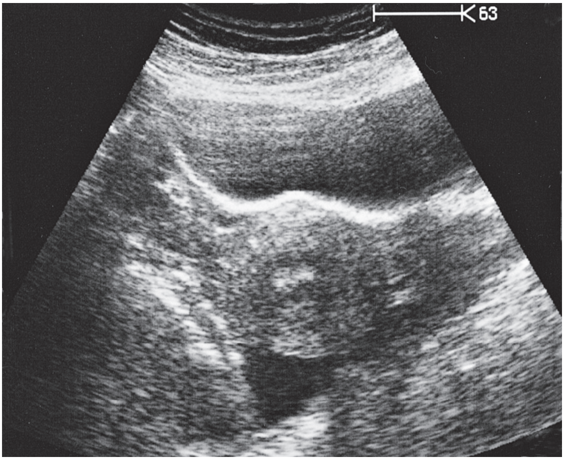


The vagina displays a streak-like lumen in cross section.

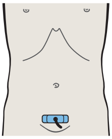


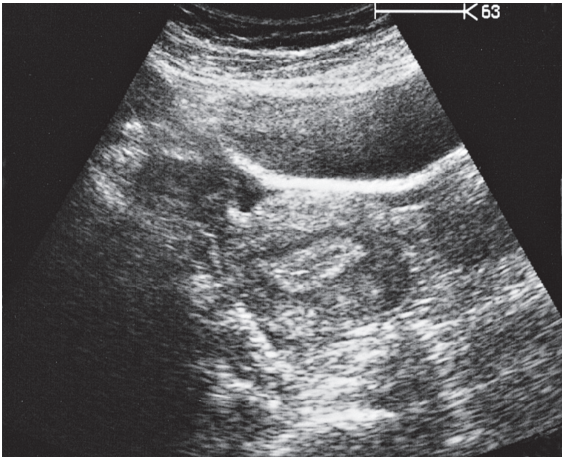
A transverse scan of the female pelvis displays the following structures, from front to back: the bladder, vesicouterine pouch, uterus, and rectum.



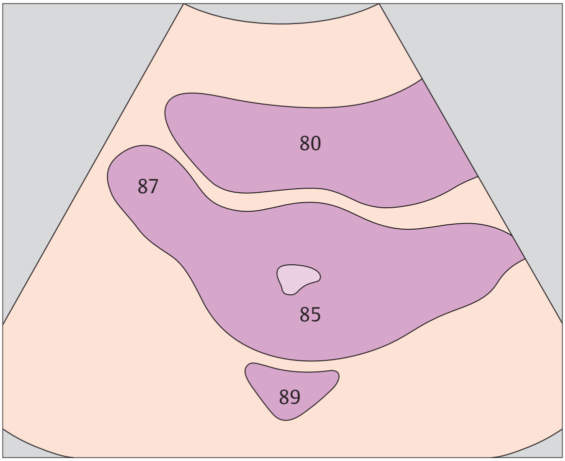


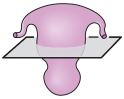
► **235** Uterus, bladder, rectum, ovary



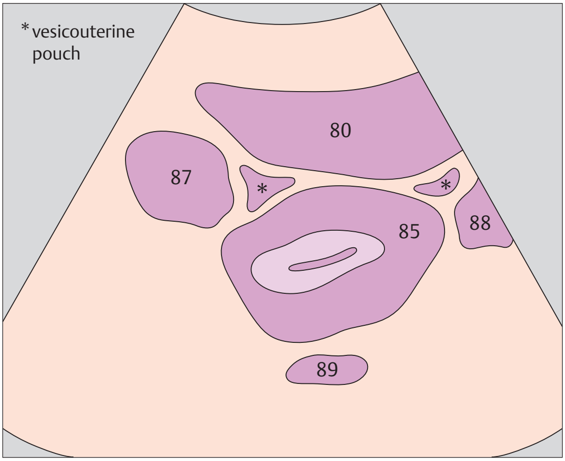


► **236** Uterus, bladder, rectum, ovaries





The ovaries are usually found lateral to the uterus, at the level of the uterine corpus. ◀


* vesicouterine pouch
80
87
*
*
85
88
89

The ovaries are rounded structures approximately 3 cm long. They are extremely variable in their location. ◀

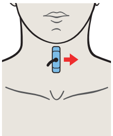
12 Thyroid Gland

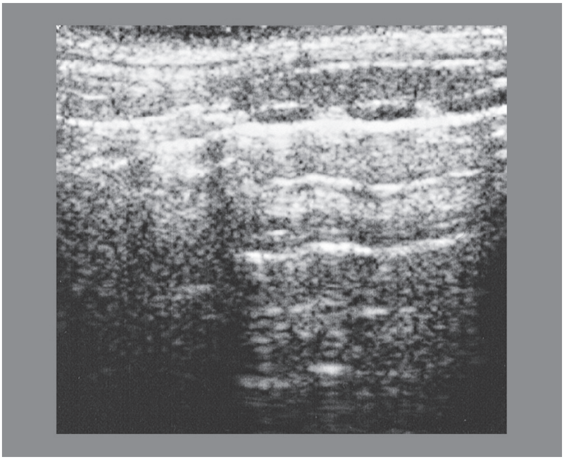
Thyroid Gland in Longitudinal Sections

237 Isthmus of thyroid gland
238 Left lobe of thyroid gland, sternohyoid muscle, sternothyroid muscle
239 Left lobe of thyroid gland, sternohyoid muscle, sternothyroid muscle, internal jugular vein
240 Left lobe of thyroid gland, sternocleidomastoid muscle, common carotid artery, internal jugular vein

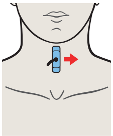
Thyroid Gland in Transverse Sections

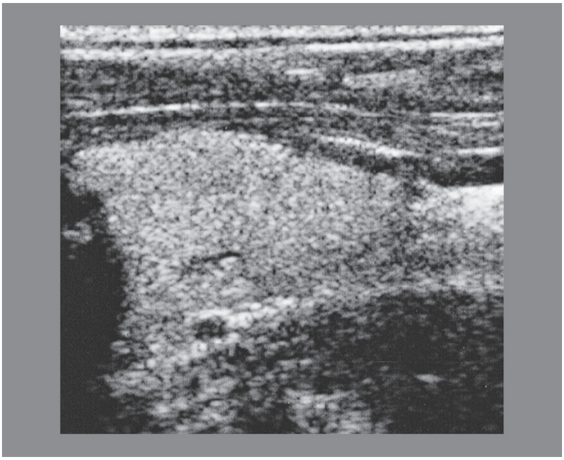
241 Right lobe of thyroid gland, sternocleidomastoid muscle, common carotid artery, internal jugular vein
242 Left lobe of thyroid gland, sternocleidomastoid muscle, omohyoid muscle, common carotid artery, internal jugular vein
243 Right lobe of thyroid gland, sternocleidomastoid muscle, omohyoid muscle, sternohyoid muscle, common carotid artery, internal jugular vein
244 Right lobe of thyroid gland, sternocleidomastoid muscle, omohyoid muscle, sternohyoid muscle, common carotid artery, internal jugular vein



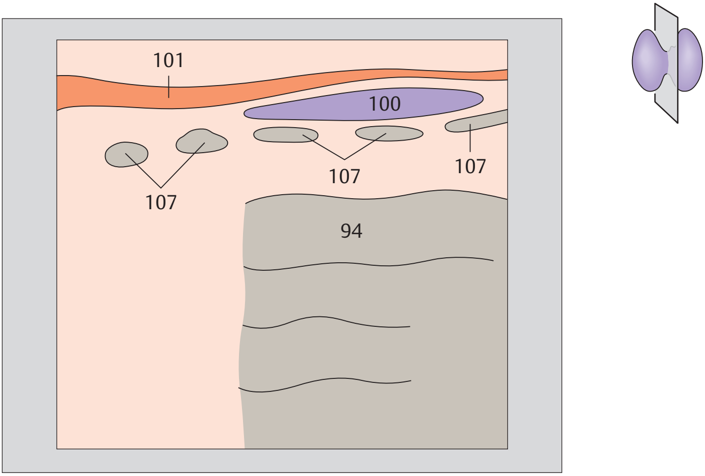


▶ **237** Isthmus of thyroid gland

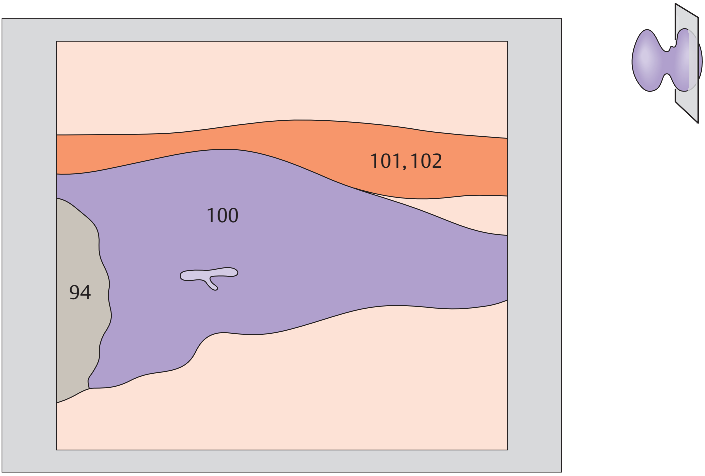




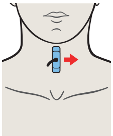
▶ **238** Left lobe of thyroid gland, sternohyoid muscle, sternothyroid muscle

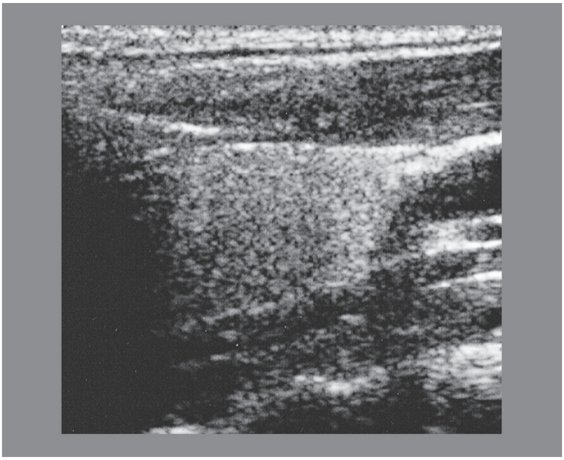

101
100
107
107
107
94

The trachea is located directly behind the thyroid isthmus.

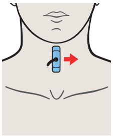

101, 102
100
94

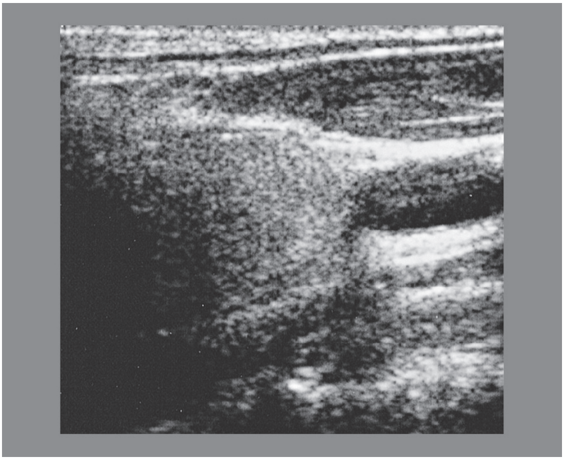
Blood vessels are seen only sporadically in the thyroid parenchyma.



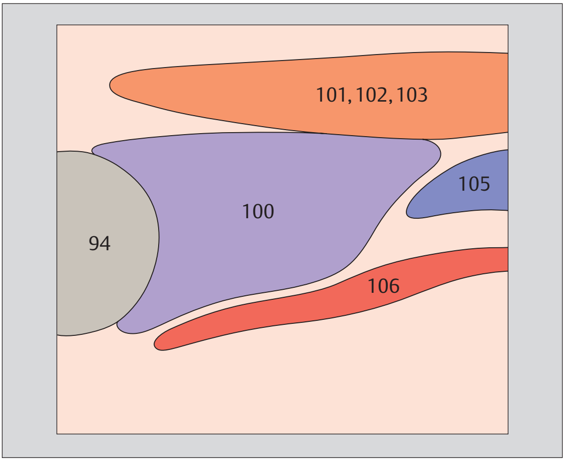


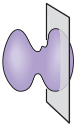
▶ **239** Left lobe of thyroid gland, sternohyoid muscle, sternothyroid muscle, sternocleidomastoid muscle, common carotid artery, internal jugular vein



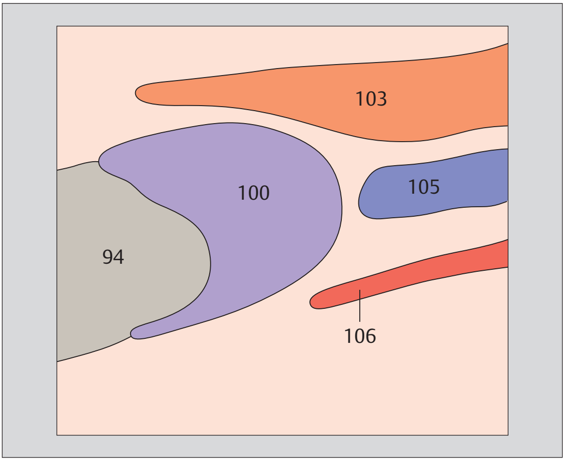


▶ **240** Left lobe of thyroid gland, sternocleidomastoid muscle, common carotid artery, internal jugular vein

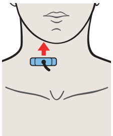

101, 102, 103
105
100
94
106

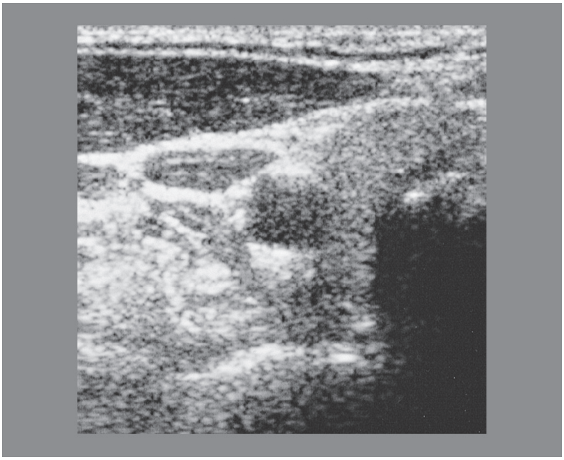


The sternohyoid and sternothyroid muscles are located anterior to the thyroid gland.

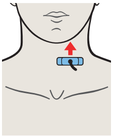

103
100
105
94
106

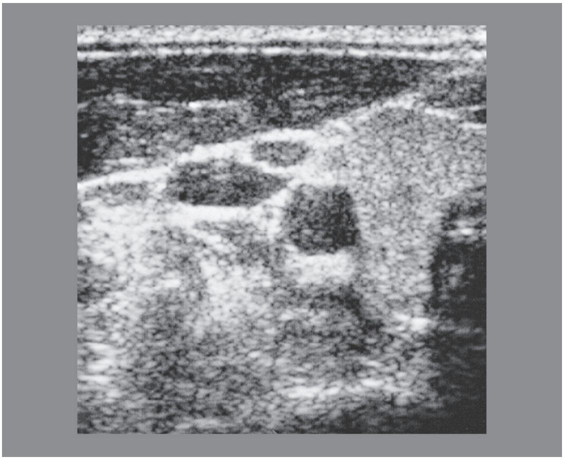
The sternocleidomastoid muscle is located anterior and lateral to the thyroid gland.



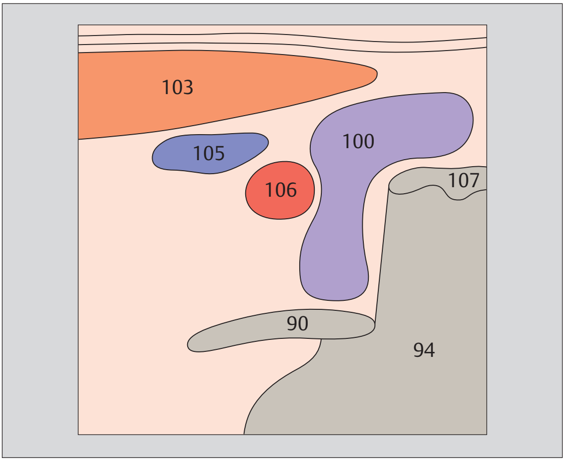


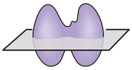
▶ **241** Right lobe of thyroid gland, sternocleidomastoid muscle, common carotid artery, internal jugular vein



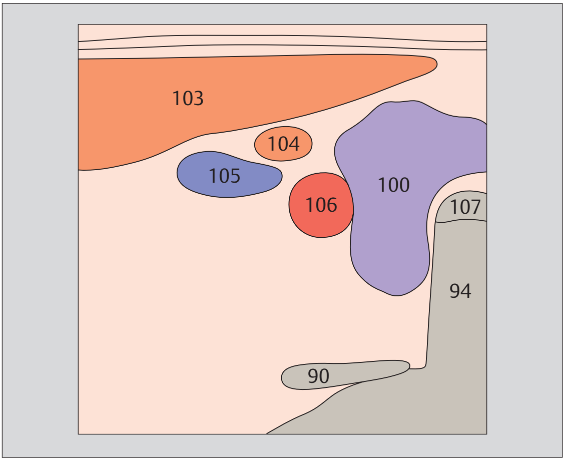


▶ **242** Left lobe of thyroid gland, sternocleidomastoid muscle, omohyoid muscle, common carotid artery, internal jugular vein

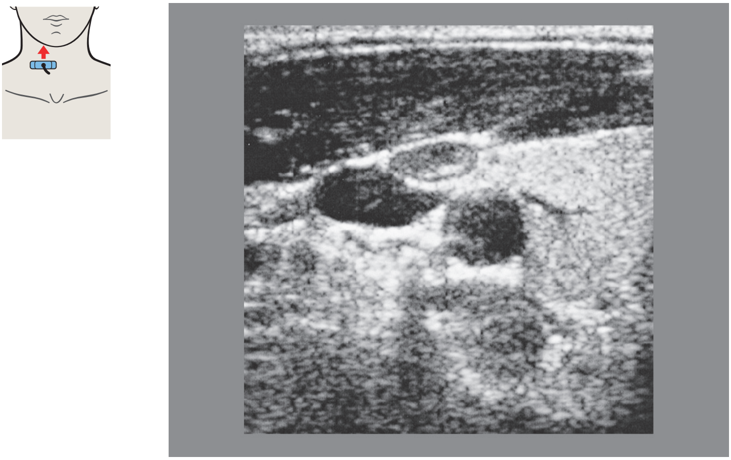

103
105
100
106
107
90
94



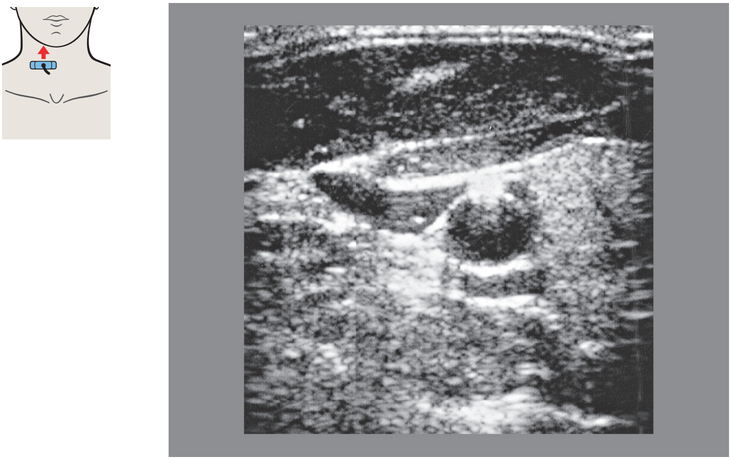
The large vessels of the neck run alongside the thyroid gland, in close proximity to it.


103
104
105
106
100
107
94
90

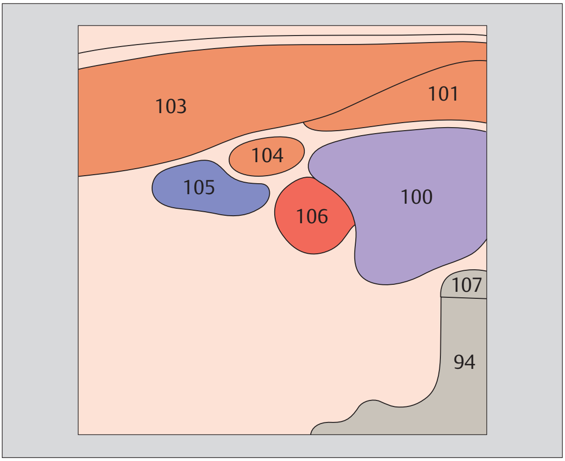
The thyroid is a butterfly-shaped gland with smooth outlines and high-level internal echoes.

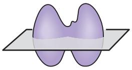


▶ **243** Right lobe of thyroid gland, sternocleidomastoid muscle, omohyoid muscle, sternohyoid muscle, common carotid artery, internal jugular vein

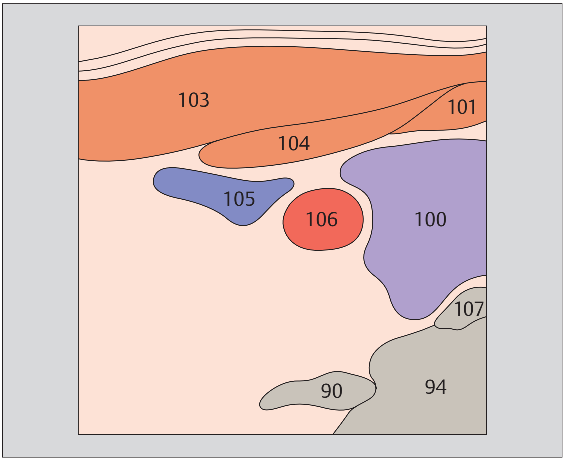


▶ **244** Right lobe of thyroid gland, sternocleidomastoid muscle, omohyoid muscle, sternohyoid muscle, common carotid artery, internal jugular vein


103
101
104
105
100
106
107
94



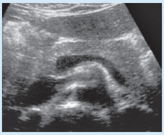
The common carotid artery is posterolateral.
The internal jugular vein is lateral or anterolateral.

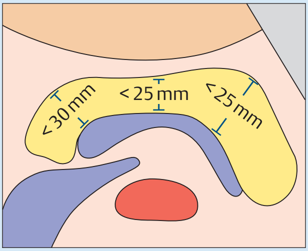

103
101
104
105
106
100
107
90
94

The parathyroid glands are located behind the upper and lower poles of the thyroid gland. Unless enlarged, they cannot be visualized with ultrasound.

Normal Sonographic Dimensions of the Pancreas, Spleen, and Kidneys

▶ Pancreas

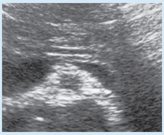



< 30 mm
< 25 mm
< 25 mm

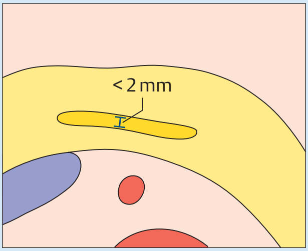
Head < 30 mm

Body < 25 mm

Tail < 25 mm

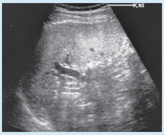


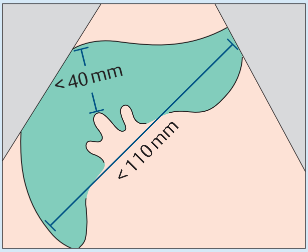
Pancreatic duct



Pancreatic duct
< 2 mm

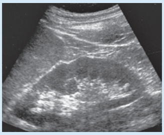
▶ Spleen

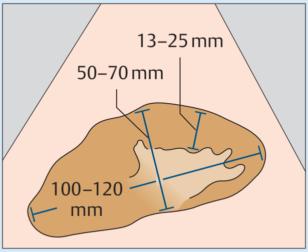




In longitudinal flank scan:
Length < 110 mm
Thickness < 40 mm

▶ Kidneys




13–25 mm
50–70 mm
100–120 mm

length 100–120 mm

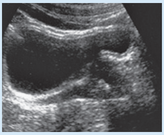
width 50–70 mm

Width of parenchyma:
13–25 mm

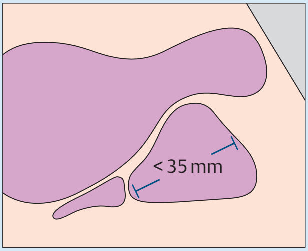
Parenchymal-pelvic ratio:
60 years or younger 1.6 : 1
Over 60 years 1.1 : 1

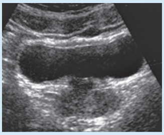
Normal Sonographic Dimensions of the Prostate and Thyroid Gland

▶ Prostate

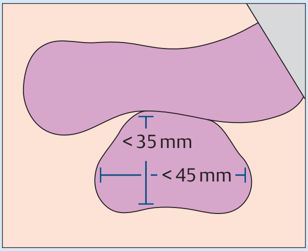


In longitudinal section





In transverse section



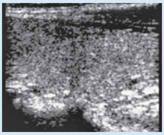
Width < 45 mm

Depth < 35 mm

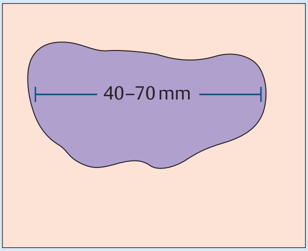
Length < 35 mm

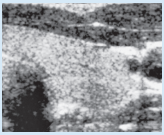
Volume < 25 mL

▶ Thyroid gland

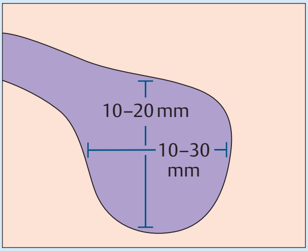


In longitudinal section





In transverse section


10–20 mm
10–30 mm

Length 40–70 mm

Width 10–30 mm

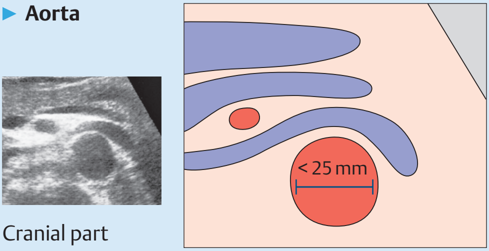
Depth 10–20 mm

Volume in men:
< 25 mL

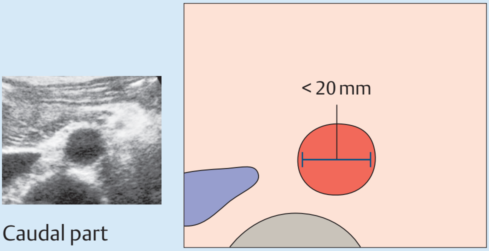
Volume in women:
< 20 mL

Normal Sonographic Dimensions of Major Vessels

Aorta

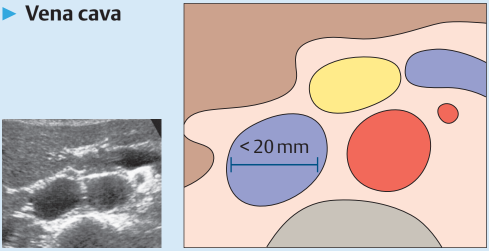


Cranial part

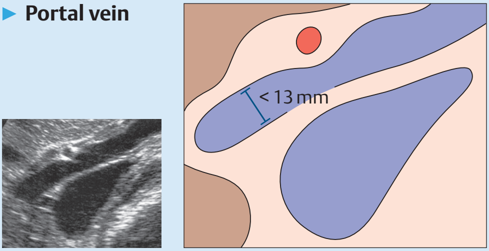


Caudal part

Vena cava

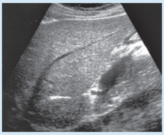


Portal vein

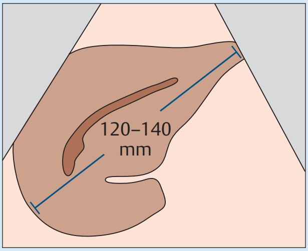


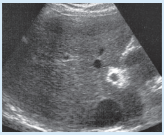
Normal Sonographic Dimensions of the Liver, Gallbladder, and Bile Duct

Liver

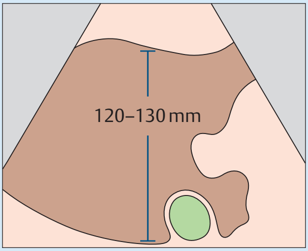


In longitudinal section





In transverse section

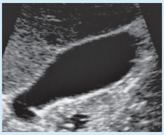


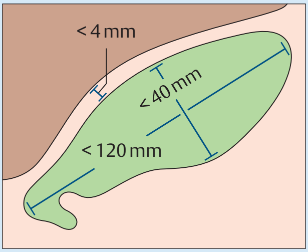
Craniocaudal
< 140 mm

Antero-posterior
< 120 mm

Angle of inferior border:
Left < 30°
Right < 45°

Gallbladder



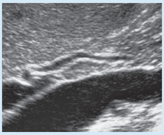

< 4 mm
< 40 mm
< 120 mm

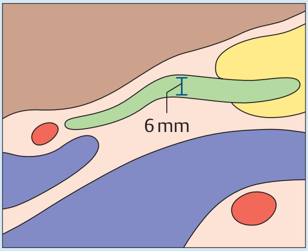
Length
< 120 mm

Width
< 40 mm

Wall thickness
< 4 mm

Bile duct





Normal width
< 6 mm

After cholecystectomy
< 9 mm

1	Aorta
2	Iliac artery
3	Celiac trunk
4	Hepatic artery
5	Splenic artery
6	Left gastric artery
7	Superior mesenteric artery
8	Right renal artery
9	Left renal artery
10	Vena cava
11	Left hepatic vein
12	Middle hepatic vein
13	Right hepatic vein
14	Right renal vein
15	Left renal vein
16	Iliac vein
17	Portal vein
18	Splenic vein
19	Superior mesenteric vein
20	Right lobe of liver
21	Left lobe of liver
22	Quadrate lobe
23	Caudate lobe
24	Ligamentum teres
25	Ligamentum venosum
26	Lateral segment
27	Medial segment
28	Anterior segment
29	Posterior segment
30	Gallbladder
31	Fundus of gallbladder
32	Body of gallbladder
33	Neck of gallbladder
34	Infundibulum
35	Spiral folds
36	Bile duct
37	Cystic duct
40	Pancreas
41	Head of pancreas
42	Body of pancreas
43	Tail of pancreas
44	Uncinate process
45	Pancreatic duct
50	Spleen
51	Accessory spleen
60	Right kidney
61	Left kidney
62	Renal cortex
63	Renal columns
64	Pyramids
65	Renal pelvis
66	Ureter
67	–
68	–
69	Adrenal gland
70	Stomach
71	Fundus of stomach
72	Body of stomach
73	Antrum of stomach
74	Cardia
75	Duodenal bulb
76	Duodenum
77	Small bowel
78	Right colic flexure
79	Left colic flexure
80	Bladder
81	Opening of ureter
82	Urethra
83	Prostate
84	Seminal vesicle
85	Uterus
86	Vagina
87	Right ovary
88	Left ovary
89	Rectum
90	Spinal column
91	Symphysis pubis
92	Acoustic shadow
93	Gas
94	Artifact
95	Psoas muscle
96	Diaphragm
97	Pelvic bone
98	Heart
100	Thyroid gland
101	Sternohyoid muscle
102	Sternothyroid muscle
103	Sternocleidomastoid muscle
104	Omohyoid muscle
105	Internal jugular vein
106	Common carotid artery
107	Tracheal cartilage